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SHUTTLE ORBITER OV-102 CDR

SAFETY ANALYSIS REPORT

VOLUME VI

AVIONICS SYSTEMS

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ABSTRACT

Hazard Analyses are presented for each subsystem of the Shuttle Orbiter OV-102 configuration, and include: subsystem descriptions, safety features and hazard analysis printout tabs. This report, "Shuttle Orbiter OV-102 CDR Safety Analysis Report," is prepared per IRD SA-045T in support of OV-102 CDR, updated to April 29, 1977, and consists of the following volumes:

SD77-SH-0001-001, Volume I Management Summary
SD77-SH-0001-002, Volume II Structural Systems
SD77-SH-0001-003, Volume III Mechanical Systems
SD77-SH-0001-004, Volume IV Propulsion Systems
SD77-SH-0001-005, Volume V Power Systems
SD77-SH-0001-006, Volume VI Avionics
SD77-SH-0001-007, Volume VII Environment Control & Life Support
SD77-SH-0001-008, Volume VIII Crew Station & Equipment

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INTRODUCTION

This Safety Analysis Report (SAR) supports the OV-102 CDR. Related SAR's in the Shuttle Orbiter program series include:

SD74-SH-0004	Shuttle Orbiter No. 1 HFT SAR
SD74-SH-0168	Shuttle Orbiter 101 Delta PDR SAR
SD74-SH-0323	Shuttle Orbiter 102 PDR SAR
SD75-SH-0064	Shuttle System PDR SAR
SD75-SH-0135	Shuttle Orbiter 101 CDR SAR
SD76-SH-0038	Shuttle Orbiter 102 Delta PDR SAR

HAZARD ANALYSIS PROCESS

The Hazard Analysis was performed per Rockwell International-Space Division, Reliability and Safety Desk Instruction 400-1. The hazard analysis process, shown in Figure 1, involves the evaluation of the Orbiter in its mission phases by subsystem identified by the System Definition Manual number for hazards in the major hazard groups described in the desk instruction and coded as listed below:

Illness/Injury/Loss of Personnel	AA
Collision/Impact/Erosion	BB
Fire/Explosion/Impllosion	CC
Loss of/Unsafe Environment	DD
Crash Landing/Ditching	EE
Loss of Flight Control	FF
Other (Not Defined)	XX

The status classifications presented in the summary are defined in the desk instruction and listed below:

Open (In-Work)	Closed (Eliminated)
Open (Residual)	Closed (Controlled)
	Closed (Accepted)

HAZARD ANALYSIS GROUND RULES

Ground rules used for the hazard analysis are as follows:

1. Hazards are identified per the rationale stated in Desk Instruction 400-1 and NHB 5300.4 (1D-1).
2. Hazard analyses are conducted according to Desk Instruction 400-1 and NHB 5300.4 (1D-1).
3. Hazard levels are as stated in NHB 5300.4 (1D-1).
4. All Criticality 1 FMEA's are analyzed for hazards.
5. All other FMEA's are reviewed for identification of potential hazards.
6. Hazards requiring three or more failures will not be considered.
7. Unless stated in the hazard analysis, equipment is presumed to be operating per specification.

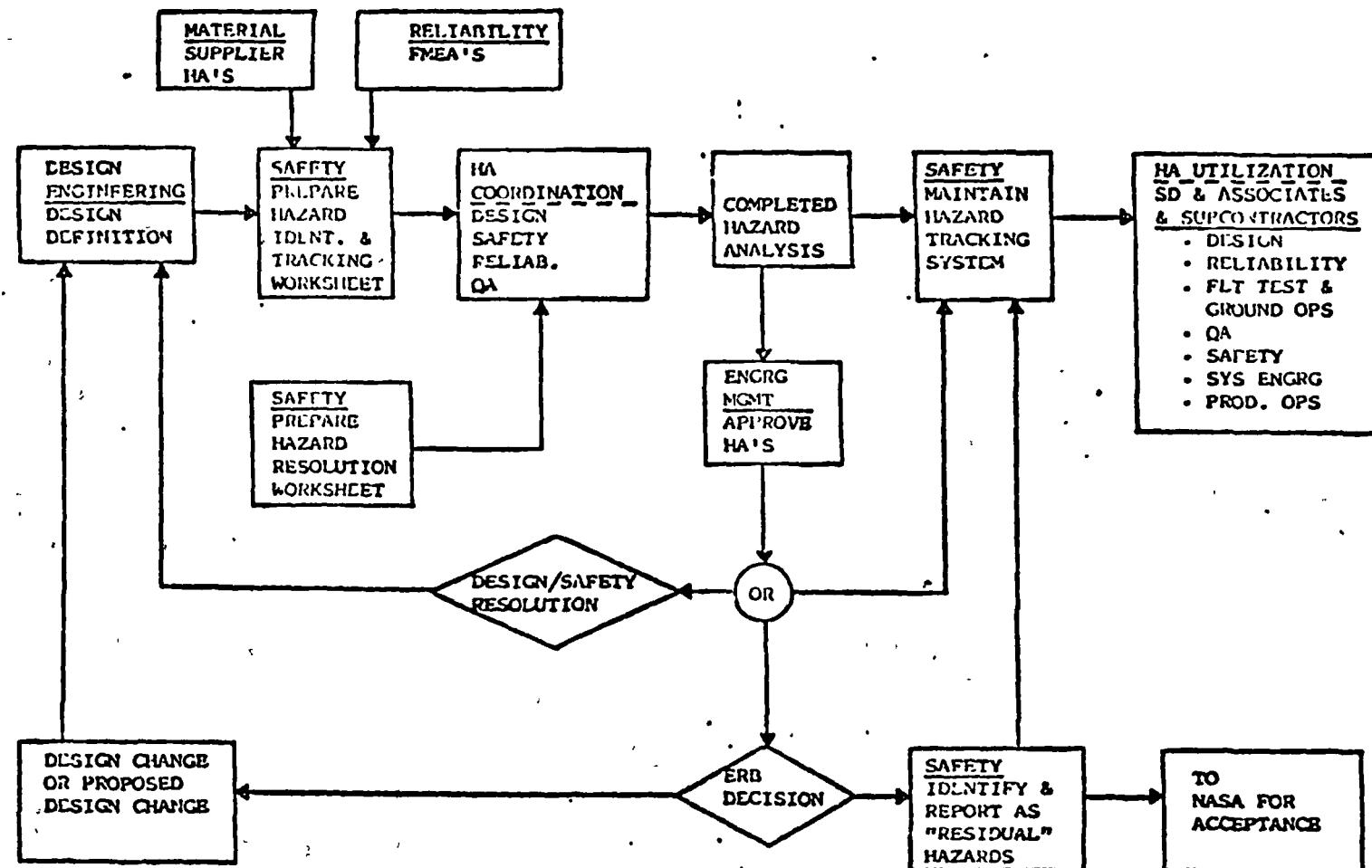


FIGURE 1 - HAZARD ANALYSIS PROCESS

ORGANIZATION OF THE REPORT

The first section of the report is a description of the individual subsystems. These are very brief descriptions and they are intended to provide sufficient technical information so that the subsequent safety data and discussions are understandable to the reader who may not be familiar with the particular system.

The second section discusses safety features which are in the particular system. A discussion of the safeguards in the system is necessary to indicate the rationale of why particular potential hazards were not documented in the hazard analysis section. An additional feature of this section is to provide some general information on the Generic Hazard Groups derived from NHB 5300.4 for the specific subsystems. This data should be useful in terms of providing additional visibility and rationale involved in the hazard analysis selection process.

The third section is a summary of the individual hazard analyses. A discussion is given to the open, i.e., in-work or residual hazards which have not been closed out as of the date of this report. The current status and resolution plans for these open potential hazards is also briefly discussed. Three tables are also included in this summary section. Table I lists the number of HA's which have been generated for the individual hazard groups (Fire, Collision, etc.) for each of the subsystems. Table II is a tabulation of all the HA's in the particular volume. This list includes an identification number so that the reader can locate a particular potential hazard in the HA section of the document. This list also provides a descriptive title and current status for the individual potential hazards. It should be noted that a Catastrophic hazard is one in which no time exists to correct the problem, whereas in a Critical hazard situation time for corrective action is available. Table III is a Mission Phase Listing of the HA's.

The last section of the report contains the individual HA's which are arranged alpha-numerically by the identification numbers previously mentioned. This kind of listing results in the HA's being grouped by subsystem. Subsystem identifiers are also included on the top of the sheets to assist in locating specific items.

SUBSYSTEM DESCRIPTIONS

GENERAL

The Shuttle Orbiter (OV-102) avionics system provides the necessary signal acquisition, handling, processing, display and powering to enable the navigation, control, and information interchange required for the Operational Flight Test (OFT) Phase of the Orbiter Program. The OV-102 avionics system is shown in block diagrams in Figure 2 (VL70-000276) and consists of the following subsystems:

- Guidance Navigation & Control
- Communications & Tracking
- Displays & Controls
- Instrumentation - OFI/DFI
- Data Processing & Software
- Electrical Power Distribution & Control
- General Purpose Computer
- Performance Monitoring Function

GUIDANCE NAVIGATION & CONTROL (GN&C)

The GN&C Subsystem is comprised of the Guidance and Navigation Group, the Air Data Group and the Flight Control Group.

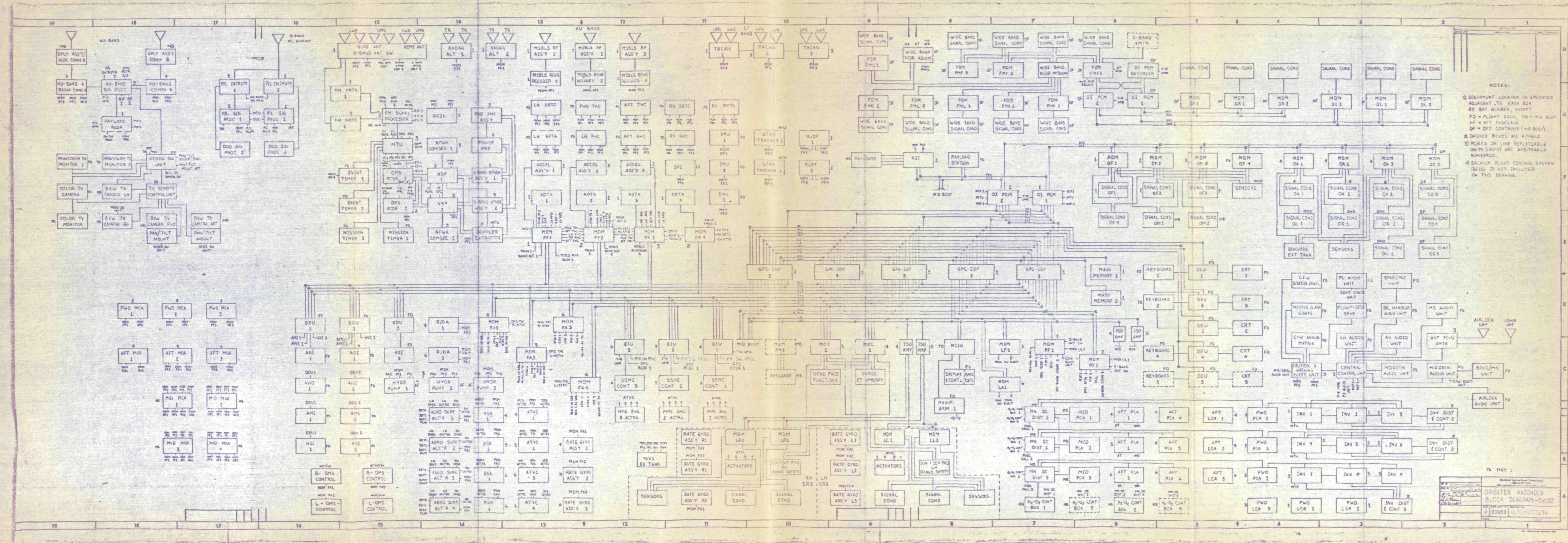
Guidance and Navigation

The Guidance and Navigation components consist of the hardware and software necessary to provide information on vehicle position, velocity, attitude, and angle of attack during all flight phases. The major assemblies include:

- Inertial Measuring Unit (IMU)
- Star Tracker and Light Shade (ST/LS)
- Navigation Base (NB)

The three IMU's are mechanized to supply vehicle attitude information and accumulated velocity change information. Each IMU consists of an all-attitude inertial stabilized platform and the associated platform electronics. The IMU's are under control of the general purpose computer and have a leveling and gyrocompassing capability in addition to the flight monitoring function.

The navigation base provides a rigid mounting for the three IMU's and the two star trackers whereby precision alignment of these critical navigation devices may be maintained throughout orbital flight.



Air Data

The Air Data components provide sensory support for the Shuttle Orbiter navigation, guidance, flight control and crew display subsystems by measuring the following parameters:

- Static pressure
- Total (or pitot) pressure
- Upper alpha port pressure
- Lower alpha port pressure
- Indicated total air temperature

These parameters are transformed in the Air Data Transducer Assemblies to provide digital inputs to the on-board computer complex so that the following air data functions may be derived:

- Pressure altitude
- Pressure altitude rate
- True dynamic pressure
- Calibrated airspeed
- True airspeed
- Mach. number
- Angle of attack
- Static air temperature

There are two sets of aerodynamic sensors or probes, each set consists of a mast-mounted pitot-static probe and a mast-mounted alpha-total temperature probe. One set is mounted on the left side of the Orbiter forward fuselage and the other set is on the right side. The probes are mechanized for stowage within the Orbiter fuselage mold-line or for deployment beyond the mold-line into the airstream. Deployment is manual and is a function of computed ground relative velocity. The probes are contoured to reduce pitot and static defect errors to within specified limits. Residual defect error corrections will be accomplished in the air data processing software.

There are four ADTA's mounted in the forward fuselage avionics bays. Two ADTA's are coupled to the left side aerodynamic probes and two are coupled to the right side probes. Thus the subsystem is dual redundant insofar as aerodynamic sensors are concerned and dual-dual redundant insofar as ADTA's are concerned. The redundancy management of these elements is effected by software routines resident in the air data processing algorithms.

The capability exists to manually enter a barometric correction setting through a keyboard to the GN&C computer. This setting is used, prior to landing, to correct the computed pressure altitude function to standard sea-level conditions based on the up-linked barometric pressure existing at the landing site.

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Flight Control

The flight control components provide automatic and manual control capability from launch through landing and runway rollout for orbital missions and for approach and landing flights of the Space Shuttle vehicle. The flight control components utilize vehicle-motion feedback sensors for stabilization and attitude control software and manual controllers as command generators; and drivers to control the effectors that include engine gimbals, reaction jets and aerodynamic-surface actuators. The flight control components (avionic-to-actuator interface) include:

- Rate gyro assembly
- Accelerometer assembly
- Rotation hand control
- Translation hand control
- Speed brake thrust control
- Rudder pedal transducer assembly
- Aerosurface servo amplifier
- Reaction jet driver forward
- Reaction jet/OMS driver
- Ascent thrust vector control (ATVC) driver

Additionally, flight control digital autopilot requirements will constitute the basic flight control mechanization for automatic and manual control in both the atmospheric and ex-atmospheric flight regimes of the Shuttle Orbiter system. The digital autopilot requirements will specify the on-board digital computations required to provide the following basic flight control functions:

- a. Stability augmentation
- b. Aerodynamic load relief and load limiting
- c. Acceleration, rate, and attitude response to commands
- d. Manual command augmentation
- e. Three-axis translational control
- f. Thrust vector control
- g. Trim control
- h. Turn coordination control
- i. Ground rollout control
- j. Attitude, attitude error, and body rate display
- k. Air data computation
- l. Fault detection, isolation, and redundancy management of above functions

Backup Flight Control System (BFS)

A BFS system with dedicated software, a dedicated backup flight controller and non-redundant GPC, is provided to circumvent a generic software error in the primary flight redundant set GPC's. Navigation sensors, the data bus and the aerosurface or RCS actuation system are shared with the primary flight control system. Switch over to BFS requires positive crew action and is a one-way changeover for the dynamic mission phases. Once in-orbit, reconfiguring to the primary system is available with the present subsystem design configuration.

COMMUNICATIONS AND TRACKING

The Communication and Tracking Subsystem consists of the RF, processing, and distribution equipment necessary to provide the following capabilities:

- a. Reception, transmission and distribution of Orbiter, ground and payload voice.
- b. Transmission of realtime and stored operational Pulse Code Modulation (PCM).
- c. Reception of payload PCM telemetry.
- d. Transmission of commands to payload(s).
- e. Receiving and channel-decoding of ground-to-Orbiter commands.
- f. Providing landing and atmospheric navigation RF aids and on-orbit tracking.
- g. Distribution and transmission of television signals.
- h. Tracking cooperative and passive targets.
- i. Installation and operation of GFE encryption and decryption equipment, TV equipment, and EVA/ATC equipment.
- j. Transmission of main engine PCM data.
- k. Transmission of payload data.

The Communication and Tracking Subsystem provides the capability to transmit and receive between the Orbiter and the following units, subject to the compatibility requirements of the applicable Interface Control Document:

- a. Other space vehicles and chase planes
- b. Payloads
- c. Extravehicular astronauts
- d. Prelaunch checkout facilities
- e. Space Tracking and Data Network (STDN)
- f. Tracking and Data Relay Satellite (TDRS)
- g. Space Ground Link System (SGLS)
- h. Orbiter vehicle landing site facilities
- i. Ground navaids

DISPLAYS AND CONTROLS

The Orbiter Displays and Controls (D&C) Subsystem consists of equipment and devices that allow the crew to supervise, control and monitor all of the Orbiter/Shuttle subsystems. It includes all of the Display and Control panels; manual controller; Cathode Ray Tube (CRT) displays; keyboards and associated electronics; display and controller encoding, decoding and conversion electronics; timing displays; Caution and Warning (C&W), and lighting provisions.

Controls

Rotation Hand Controller (RHC) - Provides manual command capability in case the crew elects to not be in the automatic mode of the primary Flight Control Subsystem. It provides for roll and pitch control capability.

Rudder Pedal Transducer Assembly - Provides manual command capability for yaw control. Rudder displacement is displayed to the crew on the surface position indicator display.

Speedbrake Thrust Controller (SBTC) - Provides manual command capability for control of the Orbiter speedbrake surfaces. This unit consists of a single control handle mechanically linked to a set of triple redundant transducers. Outputs of the SBTC are interpreted as master thrust commands for the SSME's while the ET is attached to the Orbiter.

Keyboard - It is used to interface with the CRT display and manage the information displayed. In addition, it provides an entry means to send control commands to the computers for execution.

Translation Hand Controller - Provides a means of commanding acceleration along one or more of the Orbiter body axies using RCS control authority.

Displays

Attitude Director Indicator (ADI) - Provides a simultaneous display of roll, pitch and yaw attitude angles, attitude error, and attitude angular rates. The ADI is used as a two-axis (roll and pitch) indicator for aerodynamic flight.

Surface Position Indicator (SPI) - Provides the position of the various aerodynamic control surfaces. Their positions are shown on moving pointer displays.

Alpha/Mach Indicator (AMI) - The AMI provides displays of the alpha (angle of attack), acceleration, mach number, and velocity equivalent airspeed in knots.

Altitude/Vertical Velocity Indicator (AVVI) - The AVVI provides a display of attitude acceleration, altitude rate, altitude, and radar altitude on a fixed scale with a moving pointer or on moving tapes behind a fixed lubber line.

Horizontal Situation Indicator (HSI) - Provides a display of vehicle in relationship with preselect navigation waypoints. Vehicle heading is displayed on the compass card. Bearing to the primary and secondary navigation points are displayed by bearing pointers and primary and secondary distance is displayed by the appropriate miles window.

Orbiter Display Unit - Provides a display, by means of a CRT, of the flight computers information in the form of a display page, i.e., alphanumeric and vector information. A display page is a predetermined format of static and/or dynamic data presented on the Display Unit and retrievable by crew action.

Computer Status Announcer Assembly (CSA) - Provides display of the General Purpose Computer (GPC) fault status of each GPC as determined by itself and/or other members of the operating set of GPC's.

Fire Warning Announcer Assembly (FWA) - Provides annunciation of smoke detection units that are located in the payload, cabin, left and right flight decks, and three forward avionics bays. Each sensor has its own display; the signal also actuates an emergency siren.

Caution and Warning Subsystem (C&W) - The C&W subsystem alerts the crew to malfunctions or out-of-limit conditions which may endanger the crew or Orbiter vehicle. The subsystem has a capacity of 120 input parameters and 40 lights. The subsystem also has an audible alarm, master reset switch, memory, inhibit switch and capability of changing the upper and lower limits of parameters in-flight.

INSTRUMENTATION SUBSYSTEM

The Instrumentation Subsystem consists of transducers, signal conditioning equipment, PCM encoding equipment, frequency multiplex equipment, PCM recorders, analog recorders, timing equipment, and on-board checkout equipment. The system is made up of two separate functional parts: Operational Instrumentation (OI) and Development Flight Instrumentation (DFI). The DFI will be used for development flights only and will be removed after the development phase of the program.

The OI is required to sense and acquire, condition, digitize, format and distribute data for display, telemetry, recording and checkout. The OI provides for PCM recording, voice recording, flight log recording (crash data) and master timing for on-board systems. During ground operations, the system processes and distributes ground originated commands to the on-board systems.

The DFI provides additional instrumentation similar to OI for development flights only. The DFI is required to sense and acquire, condition, digitize, format, frequency multiplex, distribute, and record data.

Major components in the instrumentation subsystem consist of the following:

Sensors - Low level sensors (10 to 100 MV output) will be used for temperatures, pressures, strains, etc.

Strain gauge pressure transducers will be used for pressure measurements. Piezoelectric transducers will be used for vibration, pressure and acoustic measurements in temperature environments of -425°F to +500°F. Resistance strain gauges will be used in measuring strains from cryogenic temperatures to 350°F.

Signal Conditioners - Signal conditioning, in general, will be accomplished in the forward or aft avionics bays and in DFI containers. The conditioners consist of charge amplifiers, active bridges, converters, etc.

PCM Equipment - is a stored program, non-destruct, read-only memory type. The equipment is capable of being programmed with several formats, selectable by external logic.

Recording Equipment - Consists of both analog and digital recorders. The digital recorders are used for storing OI or DFI PCM data and the analog recorders store voice information and frequency modulated data.

Master Timing Unit - Contains electronics equipment to provide both Greenwich mean time and mission elapsed time. These signals are serial time coded to be used for time tagging OI and DFI data, displaying time to the crew, time reference for the on-board computers and the payloads.

Wideband Data Acquisition System - It is a frequency division multiplex system using frequency modulated subcarriers. Up to 150 wideband vibration, acceleration, acoustic, and pressure data channels can be accommodated on each flight. The output of the system is recorded on tape and some data is transmitted over a real time telemetry link.

DATA PROCESSING AND SOFTWARE

The data processing and software subsystem provides on-board data processing, data transfer, data entry, and display associated with operations of the Shuttle Orbiter avionics. The subsystem consists of the following:

- Major processing elements for computation and control, and interface links.
- Magnetic tape memories for large volume bulk storage and organizational information related to individual display presentations.
- Time-shared serial digital data buses to accommodate the data traffic between the computers and the other Orbiter subsystems.

- Remote interface units to convert and format data at the various interfacing subsystems.
- Remote interface units to command and status the Orbiter main rocket engines used in ascent.
- Display units to monitor and control the Orbiter and its mission by presentation, insertion, or change of selected variables.
- Computer programs for system management and subsystem operations per the Shuttle Orbiter mission phases.

The Data Processing System equipment items are as follows:

General Purpose Computer (GPC)
 Mass Memory (MM)
 Multiplexer/Demultiplexer (MDM)
 Engine Interface Unit (EIU)
 Multifunction Cathode Ray Tube (CRT)
 Display System (MCDS)
 Various Data Bus-Associated Equipment

The GPC's, MDM's and MM's are located in the forward avionics bay. MDM's and EIU's are located in the aft avionics bay; MDM's are also located in the flight deck and mid-ship.

ELECTRICAL POWER DISTRIBUTION & CONTROL (EPD&C)

The EPD&C Subsystem provides power distribution and power control for the entire Orbiter during all operational phases. The Subsystem interfaces with all other Orbiter subsystems that require operational and signal power and includes all electrical power and signal wiring and connections/terminations throughout the Orbiter.

The EPD&C Subsystem consists of major power distribution and control assemblies including wire harnesses for distribution of direct and alternating current to all using areas of the Orbiter. These assemblies are located in the forward, mid, and aft fuselages.

The Electrical Power Distribution and Control Subsystem consists of the following major assemblies:

Inverter
 Inverter Distribution Control Assemblies
 Main DC Distribution Assemblies
 Forward DC Power Control Assemblies
 Aft DC Power Control Assemblies
 Mid DC Power Control Assemblies
 Master Event Controllers (MEC)
 Load Control Assemblies (LCA)
 Motor Control Assemblies (MCA)
 Proximity Switch Assemblies
 Midbody Pyro Controller

ECLSS Power Supply and Charger
H₂-O₂ Cryo Heater Control Assemblies
Backup Flight Control System Control Unit
DFI Power Distribution Assemblies
Wire Harnesses

The inverters, inverter distribution control, forward DC power control assemblies and ECSS power supply and charger are located in the forward fuselage avionics bays. The LCA's are located in both the forward and aft fuselage avionics bays. All of the other assemblies are located in either the forward and aft fuselage avionics bays and/or in the mid-fuselage section, except the MEC's are located in the aft avionics bays.

GENERAL PURPOSE COMPUTER (GPC)

In the OV-102, there are five GPC's comprising the Orbiter on-board computational complex. Four of the GPC's are synchronized, containing the identical primary program loads. The fifth GPC is dedicated to support of the back-up flight control system (BFS), a primary safety function.

Each GPC is a modified microprogram controlled central processing unit (CPU) with a unique input/output processor (IOP) interface to the serial data bus network. These two line replaceable units, the CPU and IOP, both contain portions of main memory which are used by either the CPU or the IOP on a non-dedicated basis. The CPU initiates all input/output actions through the execution of instructions to the IOP. These instructions and data words are transferred between the CPU and IOP on a bi-directional, parallel word data bus. Except for initiation, the IOP is independent of the CPU and executes its own programs, which reside in the common main memory. Read-only storage is used for controlling a fixed sequence of operations and internal data paths to be executed for each instruction.

PERFORMANCE MONITORING SUBSYSTEM (SYSTEM MANAGEMENT)

The Performance Monitoring Subsystem (PMS) provides two main functions, i.e., Automatic Fault Detection and Annunciation (FDA) and Subsystem Measurement Management (SMM). Other PMS functions associated with this subsystem include: (1) Subsystem Configuration Management, (2) Consumables Management, (3) Data Recording Management, (4) Telemetry Format Selection, (5) Payload Support, (6) Mission Profile Storage and Retrieval, (7) Performance Evaluation and Trend Analysis, and (8) Contingency Planning Aid.

The Automatic Fault Detection and Annunciation function is implemented entirely in software. The purpose of the function is to detect subsystem failures at the functional path level (level at which corrective action can be taken in flight) and inform the crew that the failure has occurred. Failure alarm warnings to the crew consist of: (1) a back-up Caution & Warning (C&W) Master Alarm signal that is generated whenever the failed parameter is a member of the C&W

Parameter Group, and (2) a System Management (SM) Crew Alert Alarm utilizing a small blue light and a short duration tone whenever any parameter is declared failed. These SM parameters are to be distinguished from C&W in that SM parameters are not safety-critical. The SM, however, does provide a back-up capability for the hardwired C&W subsystem to alert the crew to any detected hazardous or potentially hazardous conditions which requires attention. Back-up C&W limits are identical to primary C&W limits.

The Subsystem Measurement Management function is implemented entirely in software. The purpose of the function is to provide the crew with access to measurement data from which the degree of a problem can be assessed. This information is not forced on the CRT but must be called up on the CRT by the crew taking appropriate keyboard action.

SAFETY FEATURES

GENERAL

The avionics system safety features are a fallout of the program redundancy - of-function requirements. A primary and one or more alternate methods of accomplishing the avionics functions, or their mission alternates without risk to the crew on the orbiter are provided. General avionics hazards concern the following hazard groups:

- Fire/Explosion
- Loss of Flight Control
- Equipment Failure/Damage

Fire/Explosion

Accommodation of fire/explosion hazards is done by assessing all avionics equipment specifications to ensure that equipment to be installed in fire/explosion susceptible zones are designed to eliminate ignition sources of overt arcing/sparking or elevated LRU external case temperature. Location and severity criteria are presented in SD74-0223B. OV-102 installed avionics LRU specifications have been reviewed to ensure that avionics equipment installed external to the cabin and in a fire/explosion susceptible environment are explosion proofed or have been analyzed to ensure that LRU temperatures do not exceed minimum specified threshold values.

Loss of Flight Control

Hazards of this nature, as applied generally to all avionics equipment concern:

- Control signal loss
- Relay malfunction
- Power interruptions
- Power transients

A backup flight control system has been incorporated in the OV-102 to accommodate software drop out in the primary system. Additionally, the primary control system has a down mode capability wherein pilot inputs can override - loss of guidance sensor data in many mission phase segments.

Relay safety concerns primarily address the situation wherein relays designed to operate in a launch boost environment fail to operate under vehicle coast (quiescent conditions). The fail operational/fail safe criterion as applied to the relays, as well as the stringent vibration/non-vibration relay test environment provides a reasonable degree of confidence that the risk has been minimized.

Power interruptions have been analyzed and the electrical power distribution and control emphasizes the application of multiple bus segment ties to ensure that two failures in any bus system will not remove critical equipment from the line.

Power transients are treated by incorporating conservative power frequency/amplitude windows in all the avionics equipment specifications and requiring test verification under varying environmental and electrical conditions.

Equipment Failure/Damage

The reliability program implemented on the Shuttle Orbiter addresses failure modes and their effects. This analyzes high failure/damage critical equipment which is then separately assessed for safety hazards. Additionally "lessons learned" documents, such as MSC 00134, "Space Flight Hazards Catalog" provide checklists to ensure coverage for equipment failure/damage hazard assessment.

GUIDANCE - NAVIGATION & CONTROL

Safety concerns in the OV-102 OFT phase are alleviated in that the IMU selection criteria has been reinstated to ensure selection of the better remaining IMU (FO/FS), and air data uncertainties are being accommodated by: 1) extending availability of NAV derived data to the ground, 2) placarding initial flights to low or no wind conditions, 3) allowing altitude update acceptance by the software, and desensitizing the GN&C application programs - for example, navigation locks out the baro altimeter input in the transonic region.

COMMUNICATION & TRACKING

The most apparent communication and tracking subsystem safety feature is that of redundancy of equipments per function, and redundancy of function. The specific hazard of corona and arcing is addressed in the design phase by requiring compliance with requirement 45 of MIL-STD-454 as called out in paragraph 3.4.3 of MF-0004-002B.

DISPLAYS & CONTROLS

Special emphasis has been placed on a safety analysis and review of the design and parameter selection in the Caution and Warning (C&W) Subsystem. One of the criteria that was used in the selection of C&W parameters has been the requirement that the measurement must be safety-critical, i.e., it involves crew and/or vehicle safety. In addition, all C&W parameters require timely crew attention. The C&W subsystem has capacity for 40 lights and 120 input signals. C&W false alarms, which have occurred in other space missions, are not likely because of a transient filter design feature. In addition, the crew has the capability of changing the parameter limits or inhibiting specific parameters during the mission. Redundancy requirements for the C&W are satisfied by having a primary hardwired subsystem which is backed-up by a separate software signal from the Systems Management (SM) computer function.

The only area of C&W where there is not complete redundancy is in the transducers. There are single transducers which output to both the hard-wired C&W and also the back-up SM C&W. HA 1ZXX-0503-03 discusses this issue and points out that it is only used in FO/FS system applications. C&W power supply issues are discussed in 1ZXX-0503-10 and it is noted that redundant power is available in the C&W Electronics Unit and a "C&W Fail" annunciator is present to alert the crew to C&W malfunctions.

Several reviews have been conducted to ensure that switch guards are designed for controls that have safety-critical functions. The two most positive switch guards that are used are the lever lock toggle switches and the cover guard over push button switches. The switch guard issue is considered to be a controlled area although re-appraisals of the design will be made incrementally.

The Back-up Flight Control System (BFCS) has been added to the OV-102 vehicle design. The BFCS engage switch has been incorporated on the rotation hand controller. The BFCS adds significant flexibility in terms of crew/vehicle safety for the OFT program; this is especially true in light of undetected generic software errors in the GN&C primary system.

Abort detection, verification, and initiation is a crew initiated function. There is an abort display but that is only an "Abort Request" when a ground station detects an abort situation and recommends an abort to the orbiter crew. The actual selection of the particular abort mode, i.e., RTLS, AOA, AT0, is performed with the abort Rotary switch on the flight panel. The initiation of the abort sequence occurs when a push button switch, below the selector switch, is depressed. This abort initiation switch has a cover guard over it.

Under nominal conditions, the abort trajectory is flown in an automatic flight control mode. The flight crew's primary function will be to monitor the performance of the automatic initiated events and sequences via dedicated displays and the CRT. The crew has the capability of intervening and overriding automatic functions if malfunctions are detected.

INSTRUMENTATION

There are no open HA's associated with the Instrumentation Subsystem. Due to the degree of redundancy in this subsystem and the fact that the primary functions of this subsystem are data recording and telemetry, which are not safety-critical, failures or faults which have been identified do not pass the ground rule screening tests for HA's. However, this subsystem will continue to be assessed and if hazards are identified which are compatible with the existing HA ground rules, they will be identified in the next update.

DATA PROCESSING & SOFTWARE

The data processing system handles safety concerns by requiring multiple computers, data buses and a complete back-up computational system where critical "orbiter-get-home-and-land" functions dictate. The Advanced Development Laboratory and the Shuttle Avionics Integration Laboratory are dedicated to marrying the software to the orbiter hardware and the orbiter software function to the Shuttle mission operations. Software developed separately for the primary and back-up flight control systems provides a redundancy for critical flight software function.

REDUNDANCY MANAGEMENT

Redundancy Management (RM) is used in the GN&C subsystem. By monitoring signals using available sensory circuitry and, where required, RM dedicated software, RM controls the GN&C selection filter function. Down mode inhibit of the GN&C removes RM by inhibiting its filter selection function control, although RM continues its monitoring function. With the RM inhibited, the mid value select filter accomplishes the voting function allowing the extremes of signal excursions to be bypassed in favor of the median signals.

ELECTRICAL POWER DISTRIBUTION & CONTROL

Hazards associated with this system are concerned with loss of power and/or control and the ability of the removable equipments, as well as permanent electrical installation to survive failure and/or damage. The design philosophy of fail operational/fail safe expressly accommodates the loss of power and/or control hazards. The hazards of failure and/or damage are each accounted for and, where still "IN WORK," have resolutions based on inclusion of safety warnings, cautions and notes in the appropriate OV-102 Flight Data File documents.

COMPUTER COMPLEX

The safety concerns of the single computer complex are addressed by providing a separate computer, other than the 4GPC redundant set, in critical areas to ensure an "orbiter-get-home-and-land" capability.

PERFORMANCE MONITORING SUBSYSTEM (SYSTEM MANAGEMENT)

It is to be noted that the basic functions of the PMS are not safety-critical in that these functions do not directly involve orbiter vehicle or crew safety. The only exception to this statement is that the PMS performs a back-up function for the hardwired C&W system, in that all C&W parameters are monitored by PMS and will be annunciated on the C&W by the back-up C&W light and master alarm.

AVIONICS SYSTEM HAZARD SUMMARY

This volume of the Safety Analysis Report addresses the OV-102 Shuttle Orbiter, Vertical Flight Configuration, Avionics System. Seventy-two HA's have been identified in the Avionics area. The hazard analysis was performed in parallel with design definition and many of these hazards were identified from information in reports such as the Accident/Incident Data Bank and the JSC 00134 Space Flight Hazard Catalog that was available from previous programs. In most cases the initial design incorporated the safety features to eliminate or control these hazards, and the Safety Analysis Report listing was used as a method to check that the safety features were incorporated in the design. Table I is a summary of the number of hazards in each hazard category for each Avionics group. Table II lists each of the hazards identified, by Avionics subsystem, and their disposition. Table III is a mission phase breakdown of the HA's. Of the seventy-two hazards identified, sixty-three of these are closed and nine are open, eight of which are in an in-work status and one is a residual hazard.

Residual

1YXX-0501-09, "Redundant Paths not Adequately Separated - IMU's Collocated," addresses the issue wherein the IMU's, for purposes of accuracy and alignment integrity, are located on a common nav base. The risk associated with this design decision - that of a single gross impact and/or collision putting all IMU's out of business - is weighed against the fact that the crew and IMU's share a similar risk environment. The operational need for collocation appears to override the exposure to risk exhibited by collocation.

In-Work

1YXX-0501-04, "False Lock-On/Unlock of Star Tracker Optics," with the SAIL verification of stellar position vs. IMU position, periodic drift/rate and magnitude check software and incorporation of initial star ID procedures in the Flight Data File, this hazard will be closed.

1YXX-0501-13, "Failure to Initiate Post ET Separation Orbiter Pitch-Up During RTLS Abort," has been reopened as initial Backup Flight System specifications, MG038100-series, do not provide as yet back-up software in the RTLS abort phase to support a primary system software generic fault. These specifications have not been baselined.

1ZXX-0501-15, "Premature Nose Pitch Down at Roundout - Autoland Function Only." This hazard concerns an erroneous sequence gate entered into the FCS by a failed "Weight-on-Wheels" circuit making the vehicle believe it is on the ground while still airborne. The problem is being handled on the OV-101 through a procedural accommodation. On OV-102, the basic design is being assessed and the design approved to minimize exposure to risk has not been baselined at this time.

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1YXX-0502-03, "Leakage of MSBLS KU-Band Wave Circle Through Pressure Bulkhead Reduces Cabin Pressure," this hazard will remain open until successful completion of the vibration and pressure check and qualification tests per AVCO QTP No. 004, Rev. 3, provide assurance of waveguide pressure integrity.

1YXX-0506-04, "Inadvertent Pyro Firing Misfiring," inhibition is sensitive to the procedures in the Flight Data File. This hazard will remain open until procedures have been prepared to accommodate the above potential hazard.

1ZXX-0506-08, "Off Schedule 'Arming' or 'Disarming' of Systems," this hazard will remain open until procedures have been prepared to accommodate all "Arm" and "Disarm" conditions in the ALT phase and, later on in the OFT phase.

1ZXX-0506-10, "Failure to Deadface KU-Band Radar Boom Power Circuits Before Guillotining/Jettisoning," this hazard will be closed when the appropriate procedure to, "---- remove power before jettisoning KU-Band Radar Boom" is inserted in the Flight Data File.

1ZXX-0506-14, "Powering up Systems with Latching Relays in Unknown Positions," this hazard closure is sensitive to the procedures that will identify and accommodate the positioning of latching relays prior to powering up the systems. This study is in process.

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HAZARD GROUP APPLICATION MATRIX

Avionics Subsystems

HAZARD GROUP	CODE	AVIONICS-GENERAL	GN&C	C&T	D&C	INST.	DATA PROC. & SOFT.	EPDC	COMP.	PMF
LOSS OF PERSONNEL	AA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
COLLISION/IMPACT	BB	N/A	N/A	N/A	1	N/A	N/A	N/A	N/A	N/A
FIRE/EXPLOSION IMPLOSION	CC	1	N/A	2	1	N/A	1	N/A	N/A	N/A
LOSS OF/UNSAFE ENV.	DD	N/A	N/A	1	8	N/A	N/A	N/A	N/A	N/A
CRASH LANDING	EE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
LOSS OF FLIG. CONT.	FF	4	13	N/A	10	N/A	2	11	4	N/A
EQUIPMENT FAIL./ DAMAGE	XX	3	N/A	N/A	N/A	N/A	N/A	10	N/A	N/A

N/A - Not Applicable

TABLE I

TABLE II
HAZARD ANALYSIS SUMMARY

MODEL	SHUTTLE ORBITER OV-102 CDR			STATUS	
SUBSYSTEM GROUP	AVIONICS			OPEN	CLOSED
HAZARD NUMBER	HAZARD GROUP	PROBLEM DESCRIPTION		IN WORK	ACCOMPLISHED
		RESIDUAL	ELIMINATED	CONTROLED	
<u>GENERAL</u>					
1ZXX-0500-01	XX	Failure to Key Connectors			X
1ZXX-0500-02	XX	Use of Counterfeit Parts		X	
1ZXX-0500-03	XX	Use of Wet Tantalum Capacitors		X	
1ZXX-0500-04	FF	Momentary Power Interrupt		X	
1ZXX-0500-05	FF	Transient Power Supply		X	
1ZXX-0500-06	CC	Spurious Ignition Sources		X	
1ZXX-0500-08	FF	Failure of Relays		X	
1YXX-0500-09	FF	Premature/False Initiation of ET Separation Access		X	
<u>GN&C</u>					
1ZXX-0501-02	FF	Loss of IMU Platform Stability			X
1YXX-0501-04	FF	False Lock-On/Unlock of Star Tracker	X		X
1ZXX-0501-06	FF	Inability to Access TAEMS		X	
1ZXX-0501-07	FF	Loss of Rate Gyro Stability		X	
1YXX-0501-08	FF	Loss of Guidance System Accuracy		X	
1YXX-0501-09	FF	Redundant IMU's Collocated		X	
1YXX-0501-11	FF	Improper Air Data/Loss of Air Data		X	
1YXX-0501-12	FF	Exceeding Limit Load Factors/Entry		X	
1YXX-0501-13	FF	Failure to Initiate Post ET Pitch-Up		X	
1ZXX-0501-15	FF	Premature Nose Pitch Down at Round-Out	X	X	
1YXX-0501-50	FF	False Initiation of SSME Auto Shut-Down			X
1YXX-0501-54	FF	Failure to Obtain FCS End-To-End Check		X	
1ZXX-0501-57	FF	Failure to Disable MDM Body Flap		X	
<u>C&T</u>					
1ZXX-0502-02	CC	Corona and Arcing			X
1YXX-0502-02-01	CC	Failure of Wave Guide in RCS Bay		X	
1YXX-0502-03	DD	MSBLS Ku-Band Wave Guide Leakage		X	
<u>DISPLAYS & CONTROLS</u>					
1ZXX-0503-02	CC	False Fire Alarm			X
1ZXX-0503-03	DD	Failure of C&W to Alert Crew		X	
1ZXX-0503-04	FF	Accidental Actuation of Switch		X	
1ZXX-0503-05	FF	Insufficient C&W for BFCS Engage		X	
1ZXX-0503-07	DD	False Alarm from C&W		X	
1ZXX-0503-09	DD	Delay in Back-up C&W		X	
1ZXX-0503-10	DD	Bus Failure for C&W		X	
1ZXX-0503-11	FF	Insufficient Time to Engage BFCS		X	
1ZXX-0503-12	FF	Fail to Engage BFCS and Downmodes		X	

(continued)

TABLE II
HAZARD ANALYSIS SUMMARY

MODEL		SHUTTLE ORBITER OV-102 CDR		STATUS	
				OPEN	CLOSED
SUBSYSTEM GROUP		AVIONICS		IN-WORK PENDING	ELIMINATED CONTROLLED ACCEPTED
HAZARD NUMBER	HAZARD GROUP	PROBLEM DESCRIPTION		IN-WORK PENDING	ELIMINATED CONTROLLED ACCEPTED
DISPLAYS & CONTROLS	(Cont.)				
1ZXX-0503-13	FF	Failure in RHC			X
1YXX-0503-14	DD	Erroneous Alarm			X
1YXX-0503-15	DD	Failure of Alarm			X
1YXX-0503-16	DD	Ground Unable to Alert Crew			X
1YXX-0503-17	BB	Orbiter/Payload Collision - RHC Failure			X
1YXX-0503-18	FF	Failure to Annunciate OME Out			X
1YXX-0503-19	FF	Abort Light Illumination Cause Not Easily Discernible			X
1YXX-0503-20	FF	High "g" Loading May Prevent Control Actuation			X
1YXX-0503-21	FF	Erroneous Abort Signal			X
1YXX-0503-22	FF	OME Out Lite May Prematurely Indicate Need to Abort			X
1YXX-0503-23	DD	CO2 Level Not Annunciated			X
DATA PROC. & SOFTWARE					
1YXX-0505-02	FF	Single Fault in GPC			X
1ZXX-0505-03	FF	Overloading of Spacecraft GPC			X
1ZXX-0505-04	CC	Data Bus Coupler Ignition Source			X
EPD&C					
1YXX-0506-03	FF	Misfire of NLG Deploy Pyro			X
1YXX-0506-04	FF	Inadvertent Pyro Firing/Misfiring			X
1ZXX-0506-05	FF	Inability to Close Speed Brake Elect. Control			X
1ZXX-0506-06	FF	Lack of Redundant Relays			X
1ZXX-0506-07	XX	Inadequate Locking of Connectors			X
1ZXX-0506-08	FF	Off Schedule Arm/Disarm of Systems	X		X
1ZXX-0506-09	XX	Failure to Protect Power Supply			X
1ZXX-0506-10	XX	Failure to Deadface Guillotine Circuits	X		X
1ZXX-0506-11	XX	Mating/Demating With Power			X
1ZXX-0506-12	FF	ET Door Powering Inverter Failure/RTLS			X
1ZXX-0506-13	XX	Circuit Breakers Slow Acting			X
1ZXX-0506-14	XX	Unknown Relay State in Start-Up	X		X
1ZXX-0506-15	XX	Damage Susceptibility of Wiring Harness			X
1ZXX-0506-16	XX	Failure to Release LH ₂ /O ₂ Umbilical			X
1ZXX-0506-17	FF	Remotely Actuated Doors - Power Control Loss			X
1ZXX-0506-18	FF	Brakes Fail to Actuate			X
1ZXX-0506-19	XX	Nose Gear Steering System Loss of Control			X
(continued)					

TABLE II
HAZARD ANALYSIS SUMMARY

MODEL		SHUTTLE ORBITER OV-102		STATUS	
SUBSYSTEM GROUP		AVIONICS		OPEN	CLOSED
HAZARD NUMBER	HAZARD GROUP	PROBLEM DESCRIPTION			
EPD&C (Cont.)					
TZXX-0506-20	XX	Payload Deploy/Retrieve - Power/ Control Loss			X
1ZXX-0506-21	FF	Loss of Power to Rudder			X
1ZXX-0506-22	FF	Loss of Power to Body Flap			X
1ZXX-0506-23	FF	Payload Retention - Power/Control Loss			X
COMPUTERS					
1ZXX-0507-01	FF	Power Interrupt Causes Computer Shutdown			X
1ZXX-0507-03	FF	Manual Override Lock Out			X
1YXX-0507-04	CC	RCS Commands When Stowed			
1ZXX-0507-06	FF	Use of "Loc-Tite" With Magnetic Tape			X

TABLE III
HAZARD ANALYSIS MISSION PHASE LISTING

SUBSYSTEM GROUP: AVIONICS

HAZARD NUMBER	PROBLEM DESCRIPTION
<u>PRELAUNCH</u>	
1ZXX-0500-01	Failure to Key Connectors
1ZXX-0500-02	Use of Counterfeit Parts
1ZXX-0500-03	Use of Wet Tantalum Capacitors
1ZXX-0500-04	Momentary Power Interrupt
1ZXX-0500-05	Transient Power Supply
1ZXX-0500-06	Spurious Ignition Sources
1ZXX-0500-08	Failure of Relays
1YXX-0500-09	Premature/False Initiation of ET SEP.
1YXX-0501-54	Failure to Obtain FCS Check
1ZXX-0502-02	Corona and Arcing
1ZXX-0503-02	False Fire Alarm
1ZXX-0503-03	Failure of C&W to Alert
1ZXX-0503-07	False Alarm From C&W
1ZXX-0503-09	Delay in Back-up C&W
1ZXX-0503-10	Bus Failure for C&W
1YXX-0503-02	Single Fault in GPC
1ZXX-0505-03	GPC Overload
1ZXX-0505-04	Data Bus Coupler Ignition Source
1YXX-0506-04	Inadvertent Pyro Firing/Misfiring
1ZXX-0506-06	Lack of Redundant Relays
1ZXX-0506-07	Inadequate Locking of Connectors
1ZXX-0506-08	Off Schedule Arming/Disarming of Systems
1ZXX-0506-09	Failure to Protect Power Supply
1ZXX-0506-10	Failure to Deadface Guillotined Circuits
1ZXX-0506-11	Mating/Demating With Power
1ZXX-0506-13	Circuit Breakers Slow Acting
1ZXX-0506-14	Unknown Relay State in Start-Up
1ZXX-0506-15	Demate Susceptibility to Wiring Harness
1YXX-0506-23	Loss of Power to Payload Retention
1YXX-0507-04	RCS Commands When Stowed
1ZXX-0507-06	Use of "Loc-Tite" With Magnetic Tap
<u>LIFTOFF THRU ORBIT</u>	
1ZXX-0500-01	Failure to Key Connectors
1ZXX-0500-02	Use of Counterfeit Parts
1ZXX-0500-03	Use of Wet Tantalum Capacitors
1ZXX-0500-04	Momentary Power Interrupt
1ZXX-0500-05	Transient Power Supply
1ZXX-0500-06	Spurious Ignition Sources

(continued)

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TABLE III
HAZARD ANALYSIS MISSION PHASE LISTING

SUBSYSTEM GROUP: AVIONICS

HAZARD NUMBER	PROBLEM DESCRIPTION
<u>LIFTOFF THRU ORBIT (Cont.)</u>	
1ZXX-0500-08	Failure of Relays
1YXX-0500-09	Premature/False Initiation of ET Sep.
1ZXX-0501-02	Loss of IMU Platform Stability
1ZXX-0501-07	Loss of Rate Gyro Stability
1YXX-0501-08	Loss of Guidance System Accuracy
1YXX-0501-09	Redundant IMU's Collocated
1YXX-0501-13	Failure to Initiate Post ET Pitch-up
1YXX-0501-50	False Initiation of SSME Auto Shutdown
1YXX-0501-54	Failure to Obtain FCS Check
1ZXX-0502-02	Corona and Arcing
1ZXX-0503-02	False Fire Alarm
1ZXX-0503-03	Failure of C&W to Alert
1ZXX-0503-04	Accidental Actuation of Switch
1ZXX-0503-05	Insufficient C&W for BFCS Engage
1ZXX-0503-07	False Alarm From C&W
1ZXX-0503-09	Delay in Back-up C&W
1ZXX-0503-10	Bus Failure for C&W
1ZXX-0503-11	Insufficient Time to Engage BFCS
1ZXX-0503-12	Fails to Engage BFCS and Downmodes
1ZXX-0503-13	Failure in RHC
1YXX-0503-14	False Rapid Depress Alarm
1YXX-0503-15	Rapid Depress Alarm Fails
1YXX-0503-18	OMS Alarm for Abort
1YXX-0503-19	Lack of Abort Verification
1YXX-0503-20	"G" Forces in Abort Situation
1YXX-0503-21	Erroneous Abort Light
1YXX-0503-22	OMS Engine Out Causes Abort
1YXX-0503-23	No Alarm for CO ₂ Build-up
1ZXX-0505-03	GPC Overload
1ZXX-0505-04	Data Bus Coupler Ignition Source
1YXX-0506-03	Misfire of NLG Pyro
1YXX-0506-04	Inadvertent Pyro Firing/Misfiring
1ZXX-0506-06	Lack of Redundant Relays
1ZXX-0506-07	Inadequate Locking of Connectors
1ZXX-0506-08	Off Schedule Arming/Disarming of Systems
1ZXX-0506-09	Failure to Protect Power Supply
1ZXX-0506-10	Failure to Deadface Guillotined Circuits
1YXX-0506-12	ET Door Powering Inverter Failure
1ZXX-0506-13	Circuit Breathers Slow Acting

(continued)

TABLE III
HAZARD ANALYSIS MISSION PHASE LISTING

SUBSYSTEM GROUP: AVIONICS

HAZARD NUMBER	PROBLEM DESCRIPTION
<u>LIFTOFF THRU ORBIT (Cont.)</u>	
1ZXX-0506-15	Damage Susceptibility to Wiring Harness
1YXX-0506-16	Failure to Release LH ₂ /O ₂ Umbilical
1YXX-0506-17	Remotely Actuated Doors - Power Loss
1ZXX-0506-21	Loss of Power to Rudder
1ZXX-0506-22	Loss of Power to Body Flap
1YXX-0506-23	Loss of Power to Payload Retention
1ZXX-0507-01	Power Interrupt Causes Shutdown
1ZXX-0507-03	Manual Override Lockout
1YXX-0507-04	RCS Commands When Stowed
1ZXX-0507-06	Use of "Loc-Tite" with Magnetic Tape
<u>ON-ORBIT</u>	
1ZXX-0500-01	Failure of Key Connectors
1ZXX-0500-02	Use of Counterfeit Parts
1ZXX-0500-03	Use of Wet Tantalum Capacitors
1ZXX-0500-04	Momentary Power Interrupt
1ZXX-0500-05	Transient Power Supply
1ZXX-0500-06	Spurious Ignition Sources
1ZXX-0500-08	Failure of Relays
1ZXX-0501-02	Loss of IMU Platform Stability
1YXX-0501-04	False Lock-On/Unlock of Star Tracker
1ZXX-0501-07	Loss of Rate Gyro Stability
1YXX-0501-08	Loss of Guidance System Accuracy
1YXX-0501-09	Redundant IMU's Collocated
1ZXX-0502-02	Corona and Arcing
1YXX-0502-02-01	Failure of Waveguide in RCS Bay
1YXX-0502-03	MSBLS KU-Band Waveguide Leakage
1ZXX-0503-02	False Fire Alarm
1ZXX-0503-03	Failure of C&W to Alert
1ZXX-0503-07	False Alarm From C&W
1ZXX-0503-09	Delay in Back-up C&W
1ZXX-0503-10	Bus Failure for C&W
1YXX-0503-14	False Rapid Depress Alarm
1YXX-0503-15	Rapid Depress Alarm Fails
1YXX-0503-16	Ground Station Uplink Alarm
1YXX-0503-17	Payload Collision With Orbiter
1YXX-0503-23	No Alarm for CO ₂ Build-up
1ZXX-0505-03	GPC Overload
1ZXX-0505-04	Data Bus Coupler Ignition Source
1YXX-0506-03	Misfire of NLG Pyro
1YXX-0506-04	Inadvertent Pyro Firing/Misfiring
1ZXX-0506-06	Lack of Redundant Relays
1ZXX-0506-07	Inadequate Locking of Connectors
1ZXX-0506-08	Off Schedule Arming/Disarming of Systems
1ZXX-0506-09	Failure to Protect Power Supply

(continued)

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TABLE III

HAZARD ANALYSIS MISSION PHASE LISTING

SUBSYSTEM GROUP: AVIONICS

HAZARD NUMBER	PROBLEM DESCRIPTION
<u>ON ORBIT (Cont.)</u>	
1ZXX-0506-10	Failure to Deadface Guillotined Circuits
1ZXX-0506-13	Circuit Breakers Slow Acting
1ZXX-0506-15	Damage Susceptibility to Wiring Harness
1YXX-0506-20	Payload Deploy/Retrieve Control Loss
1YXX-0506-23	Loss of Power to Payload Retention
1YXX-0507-04	RCS Commands When Stowed
1ZXX-0507-06	Use of "Loc-Tite" With Magnetic Tape
<u>DEORBIT THRU LANDING</u>	
1ZXX-0500-01	Failure to Key Connectors
1ZXX-0500-02	Use of Counterfeit Parts
1ZXX-0500-03	Use of Wet Tantalum Capacitors
1ZXX-0500-04	Momentary Power Interrupt
1ZXX-0500-05	Transient Power Supply
1ZXX-0500-06	Spurious Ignition Sources
1ZXX-0501-02	Loss of IMU Platform Stability
1YXX-0501-06	Inability to Access TAEMS
1ZXX-0501-07	Loss of Rate Gyro Stability
1YXX-0501-08	Loss of Guidance System Accuracy
1YXX-0501-09	Redundant IMU's Collocated
1YXX-0501-11	Improper Air Data/Loss of Data
1YXX-0501-12	Exceeding Limit Load Factors
1YXX-0501-13	Failure to Initiate Post ET Pitch-Off
1ZXX-0501-15	Premature Pitch Down at Round Out
1YXX-0501-54	Failure to Obtain FCS Check
1ZXX-0501-57	Failure to Disable Body Flap
1ZXX-0502-02	Corona and Arcing
1YXX-0502-02-01	Failure of Waveguide in RCS Bay
1ZXX-0503-02	False Fire Alarm
1ZXX-0503-03	Failure to C&W to Alert
1ZXX-0503-04	Accidental Actuation of Switch
1ZXX-0503-05	Insufficient C&W for BFCS Engage
1ZXX-0503-07	False Alarm From C&W
1ZXX-0503-09	Delay in Back-up C&W
1ZXX-0503-10	Bus Failure for C&W
1ZXX-0503-11	Insufficient Time to Engage BFCS
1ZXX-0503-12	Fails to Engage BFCS and Downmodes

(continued)

TABLE III
HAZARD ANALYSIS MISSION PHASE LISTING

SUBSYSTEM GROUP: AVIONICS

HAZARD NUMBER	PROBLEM DESCRIPTION
<u>DEORBIT THRU LANDING (Cont.)</u>	
1ZXX-0503-13	Failure in RHC
1YXX-0503-14	False Rapid Depress Alarm
1YXX-0503-15	Rapid Depress Alarm Fails
1YXX-0503-23	No Alarm for CO ₂ Build-up
1ZXX-0505-03	GPC Overload
1ZXX-0505-04	Data Bus Coupler Ignition Source
1YXX-0506-03	Misfire of NLG Pyro
1YXX-0506-04	Inadvertent Pyro Firing/Misfiring
1ZXX-0506-05	Inability to Close Speedbrake
1ZXX-0506-06	Lack of Redundant Relays
1ZXX-0506-07	Inadequate Locking of Connectors
1ZXX-0506-08	Off Schedule Arming/Disarming of Systems
1ZXX-0506-09	Failure to Protect Power Supply
1ZXX-0506-10	Failure to Deadface Guillotined Circuits
1ZXX-0506-13	Circuit Breakers Slow Acting
1ZXX-0506-14	Unknown Relay State in Start-up
1ZXX-0506-15	Damage Susceptibility to Wiring Harness
1ZXX-0506-17	Remotely Actuated Doors - Power Loss
1ZXX-0506-18	Brakes Fail to Actuate
1ZXX-0506-19	Nose Gear Steering Control Loss
1ZXX-0506-21	Loss of Power to Rudder
1ZXX-0506-22	Loss of Power to Body Flap
1YXX-0506-23	Loss of Power to Payload Retention
1ZXX-0507-01	Power Interrupt Causes Shutdown
1ZXX-0507-03	Manual Override Lockout
1YXX-0507-04	RCS Commands When Stowed
1ZXX-0507-06	Use of "Loc-Tite" With Magnetic Tape

HAZARD ANALYSIS LISTING

The tabular listing of hazard analyses are included. The initial and tracking level listings are as follows:

- CA Catastrophic: no time available to accommodate potential hazard.
- CR Critical: time available to react to potentially hazardous situation.
- CA/CN Catastrophic potential hazard having methodology identified to control hazard..
- CR/CN Critical potential hazard having methodology identified to control hazard.
- CN/CN Potential hazard that has been controlled or eliminated.

Note: CA or CR tracking status indicates an open hazard. CA/CN or CR/CN indicates a conditionally control hazard and CN/CN is a closed hazard.

APPENDIX A
Avionics Systems Hazard Analysis Printout

HA-TRACK

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HAZARD ANALYSIS NUMBER	SUBSYSTEM/EQUIPMENT OR OPERATION	LEVEL INIT	HZD TRACK	HAZARD CAT	STATUS	ENTRY DATE
12XX-0500-01	AVIONICS-GENERAL	CR	CN/CN	23	CONTROLLED	082974

HAZARD DESCRIPTION

FAILURE TO KEY ELECTRICAL CONNECTORS IN A WAY THAT POSITIVELY
PREVENTS INTERCHANGING WITH OTHER ACCESSIBLE CONNECTORS

FLIGHT TEST	GROUND TEST	FERRY FLIGHTS	ORBITAL MISSION	OTHER	X
ALL MISSION PHASES					
PRELAUNCH	LIFT OFF THRU ORBIT	ON ORBIT	DE-ORBIT THRU	LANDING	

HAZARD GROUP XX EQUIPMENT DAMAGE

RESP.ENGR. R.F.RAASCH

RELATED FMEAS

FMEA REQD YES NO

NONE

X

REFERENCES

MSC 00134 REV A #32

HAZARD CAUSES

ADJACENT CONNECTORS SIMILARLY KEYED AND CROSS CONNECTED OR
INADEQUATE MARKING OF MATING PLUGS AND WIRE TO INDICATE
CORRECT MATING CONNECTIONS OR TERMINATION POINTS

HAZARD EFFECTS

DAMAGE TO EQUIPMENT

RELATED HAZARD ANALYSES

NONE

HAZARD NUMBER 1ZXX-0500-01

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD -INTERFACE-	SAFETY LEAD W.E.PLAISTED
DISPOSITION	RESP GRP ACTION DOCUMENTATION
01-KEY CONNECTORS PER PARA 3.6.8. OF MF0004-002	392-ALL MF0004-002
02-PROVIDE DESIGN INSPECTION OF WIRE SEGMENT HARNESS MOCK-UPS PRIOR TO FABRICATION OF HAR- NESS	392-080 ML0303-0014
03-COLOR CODE ADJACENT CONNECTORS WITH SIMILAR SIZED SHELLS	392 ML0303-0014
04-VERIFY LAY OF HARNESS UPON INSTALLATION	392-C80 INSTALLATION PRACTICE
05-VERIFY NUMBER MATCH OF CONN- ECTOR HALF TO CONNECTOR HALF	047 STANDARD INSPECTION PROCEDURES

CLOSURE RATIONALE

HAZARD CLOSED BASED ON ABOVE STEPS TAKEN IN CORRECTIVE ACTIONS
AS STANDARD PRACTICE IN THE DESIGN, FABRICATION, INSTALLATION,
AND INSPECTION OF WIRE SEGMENTS CONTAINING CONNECTING DEVICES

HAZARD DISPOSITION CONCURRENCE

FUNCTIONAL SUPERVISION DEP-GRP	DATE	SAFETY SUPERVISION	DATE
-INTERFACE-	101575	F.J.ATTAWAY	101575

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SD77-SN-0001-06

HA-TRACK

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HAZARD ANALYSIS NUMBER	SUBSYSTEM/EQUIPMENT OR OPERATION	LEVEL INIT	HZD TRACK	HAZARD CAT	STATUS	ENTRY DATE
1ZXX-0500-02	AVIONICS-GENERAL	CR	CN/CN	23	CONTROLLED	011675

HAZARD DESCRIPTION

INADVERTENT USE OF COUNTERFEIT ELECTRONIC PARTS

FLIGHT TEST GROUND TEST FERRY FLIGHTS ORBITAL MISSION OTHER X
ALL FLIGHT & GROUND OPERATIONS
PRELAUNCH LIFT OFF THRU ORBIT ON ORBIT DE-ORBIT THRU LANDING

HAZARD GROUP XX EQUIPMENT FAILURE/DAMAGE RESP.ENGR. R.F.RAASCH

RELATED FMEAS

FMEA REQD YES NO

FMEA SYSTEM

X

REFERENCES

MSC 00134 REV A #47

HAZARD CAUSES

01-MISLABELLING OF PARTS
02-FRAUDULENT MARKETING OF MISLABELLED PARTS

HAZARD EFFECTS

FAILURE OF EQUIPMENT OR DAMAGE TO ASSOCIATED CIRCUITRY

RELATED HAZARD ANALYSES

NONE

34

60-100-000-2265

HAZARD NUMBER 1ZXX-0500-02

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD M.L.ADAMS

SAFETY LEAD W.E.PLAISTED

DISPOSITION

RESP GRP ACTION DOCUMENTATION

01602

PARTICIPATE IN NASA-ALERT
SYSTEM
PROVIDE FOR CLOSELY CONTROLLED
RELIABILITY & DEVELOPMENT
TESTING
CONDUCT FMEAS TO IDENTIFY
SINGLE FAULT PATHS

394-400
394-301
394-101
394-103

CLOSURE RATIONALE

THIS HAZARD IS CLOSED BASED ON THE ADMINISTRATIVE SYSTEM SET UP
IN THE R&S DESK INSTRUCTIONS TO ENSURE ACCOMPLISHMENT OF
ITEMS NOTED IN CORRECTIVE ACTION, ABOVE

HAZARD DISPOSITION CONCURRENCE

FUNCTIONAL SUPERVISION DEP-GRP DATE SAFETY SUPERVISION DATE

M.L.ADAMS

394-301 061875

F.J.ATTAWAY

070775

HA-TRACK

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HAZARD ANALYSIS NUMBER	SUBSYSTEM/EQUIPMENT OR OPERATION	LEVEL INIT	HZD TRACK	HAZARD CAT	STATUS	ENTRY DATE
1ZXX-0500-03	AVIONICS-GENERAL	CR	CN/CN	23	CONTROLLED	011675

HAZARD DESCRIPTION

INJUDICIOUS APPLICATION OR INADEQUATE SCREENING OF WET SLUG
TANTALUM CAPACITORS

FLIGHT TEST	GROUND TEST	FERRY FLIGHTS	ORBITAL MISSION	OTHER X
ALL FLIGHT & GROUND PHASES				
PRELAUNCH	LIFT OFF THRU ORBIT	ON ORBIT	DE-ORBIT THRU	LANDING

HAZARD GROUP XX EQUIPMENT DAMAGE

RESP.ENGR. R.F.RAASCH

RELATED FMEAS

N/A

FMEA REQD YES NO

X

REFERENCES

MSC 00134 #20

HAZARD CAUSES

ABSENCE OF SELECTION CONTROLS, SCREENING AND ABSENCE OF DEVICE
APPLICATION ANALYSIS IN CIRCUITRY

HAZARD EFFECTS

POSSIBLE CHANGE IN CAPACITY OR RATING OF CAPACITOR & SUBSEQUENT
FAILURE OF, OR DAMAGE TO ADJACENT OR ASSOCIATED CIRCUITRY

HAZARD NUMBER 1ZXX-0500-03

RELATED HAZARD ANALYSES

NONE

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD M.L.ADAMS	SAFETY LEAD W.E.PLAISTED
DISPOSITION	RESP GRP ACTION DOCUMENTATION
USER REQUIRED TO JUSTIFY SPECIFIC APPLICATION OF WET SLUG TANTALUM CAPACITORS.	394-301 RI/SD IL 394-301-74-204 DTD 24 SEPTEMBER 1974

CLOSURE RATIONALE

EACH USAGE OF WET SLUG TANTALUM CAPACITORS IS IDENTIFIED AND PROCESSED THROUGH NASA-JSC FOR PROJECT MANAGER APPROVAL PER NASA JSC LETTER NB/74-L172, DTD 20 AUG 1974, "USE OF WET TANTALUM SLUG CAPACITORS FOR THE SPACE SHUTTLE PROGRAM"

HAZARD DISPOSITION CONCURRENCE

FUNCTIONAL SUPERVISION DEP-GRP	DATE	SAFETY SUPERVISION	DATE
M.L.ADAMS	394-301	030475	F.J.ATTAWAY
			030475

HAZARD ANALYSIS NUMBER	SUBSYSTEM/EQUIPMENT OR OPERATION	LEVEL INIT	HZD TRACK	CAT	HAZARD STATUS	ENTRY DATE
1ZXX-0500-04	AVIONICS-GENERAL	CA	CN/CN	123	CONTROLLED	071+74

HAZARD DESCRIPTION

MOMENTARY POWER INTERRUPTIONS TO CRITICAL ELECTRONIC EQUIPMENT

FLIGHT TEST	GROUND TEST	FERRY FLIGHTS	ORBITAL MISSION	OTHER X
ALL MISSION PHASES				
PRELAUNCH	LIFT OFF THRU ORBIT	ON ORBIT	DE-ORBIT THRU	LANDING

HAZARD GROUP FF LOSS OF FLIGHT CONTROL RESP.ENGR. R.F.RAASCH

RELATED FMEAS

05-6(SERIES) PER PART

FMEA REQD YES NO

X

REFERENCES

MSC-00135,REV A.,ITEM 39

HAZARD CAUSES

- 01-LIGHTNING STRIKE
- 02-PART FAILURE
- 03-BUSS TRANSIENTS

HAZARD EFFECTS

LOSS OF PERSONNEL AND/OR VEHICLE.WORST CASE

HAZARD NUMBER 1ZXX-0500-04

RELATED HAZARD ANALYSES

01-1ZXX-0507-01, 1ZXX-0500-05, 03-1ZXX-0500-05

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD T.QUEBEAUX

SAFETY LEAD W.E.PLAISTED

DISPOSITION

- 01-MULTIPLE DC BUS SEGMENTS ON CRITICAL EQUIPMENT TO PRECLUDE COMPLETE POWER LOSS OR INTERRUPTION AND ENSURE TWO OR MORE DC SUPPLY SOURCES TO THE EQUIPMENT PER THE RELATED VS70-SERIES POWER WIRING SCHEMATIC
02-FMEA'S CONDUCTED ON SYSTEMS TO ENSURE FO/FS OR FS IN CRITICAL OPERATIONS
03-SEE HA 1ZXX-0500-05

RESP GRP ACTION DOCUMENTATION

- 392-c10 VS70-SERIES WIRING DIAGRAMS
UV-101 FLT UPS DOES NOT ALLOW FLT IN LIGHTNING ENVIRON

394-103 MCR 955

CLOSURE RATIONALE

HAZARD IS CLOSED BASED ON THE ACCOMPLISHMENT OF CORRECTIVE ACTION ITEMS LISTED ABOVE AND AS INDICATED IN CERTIFICATION PLAN SD74-SH-0049 (CALLING OUT THE VS70-SERIES WIRING DIAGRAMS) AND MCR 955

HAZARD DISPOSITION CONCURRENCE

FUNCTIONAL SUPERVISION DEP-GRP	DATE	SAFETY SUPERVISION	DATE
L.A.UPDEGRAFF	062075	F.J.ATTAWAY	070775

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HAZARD ANALYSIS NUMBER	SUBSYSTEM/EQUIPMENT OR OPERATION	LEVEL INIT	HZD TRACK CAT	HAZARD STATUS	ENTRY DATE
1ZXX-0500-05	ELECT.PWR.DIST & CON	CR	CN/CN 12	CONTROLLED	021475

HAZARD DESCRIPTION

INABILITY OF ELECTRONIC EQUIPMENT TO MAINTAIN UNDISTURBED
OPERATION IN THE PRESENCE OF TRANSIENT SUPPLY VOLTAGE PULSES
SHORTER THAN THE RESPONSE TIME OF POWER SYSTEM REGULATORS

FLIGHT TEST ALL MISSION PHASES	GROUND TEST	FERRY FLIGHTS	ORBITAL MISSION	OTHER X
PRELAUNCH	LIFT OFF THRU ORBIT	ON ORBIT	DE-ORBIT THRU	LANDING

HAZARD GROUP FF LOSS OF FLIGHT CONTROL RESP.ENGR. R.F.RAASCH

RELATED FMEAS FMEA REQD YES NO

05-6(SERIES) PER EQUIPMENT X

REFERENCES

MSC 00134 REV A #149

HAZARD CAUSES

01-BUSS TRANSIENTS
02-PART/EQUIPMENT FAILURE

HAZARD EFFECTS

EQUIPMENT DAMAGE AND POSSIBLE LOSS OF VEHICLE AND PERSONNEL

HAZARD NUMBER 1ZXX-0500-05

RELATED HAZARD ANALYSES

01-1ZXX-0500-04

HAZARD IDENTIFICATION CONCURRENCE

· FUNCTIONAL LEAD -INTERFACE-

DISPOSITION

01-PARAGRAPHS 3.2 OF MFC004-002
REQUIRES DEFINITION OF POWER
PROFILE FOR EACH EQUIPMENT
SPECIFICATION. PARA 4. OF LRU
SPECIFICATIONS DEFINE TESTS TO
ENSURE COMPLIANCE

02-FMEA'S ARE CONDUCTED ON ALL
AVIONIC EQUIPMENTS TO DETER-
MINE CRITICAL FAILURE MODES
AND ENSURE A MINIMUM FAIL
SAFE CONDITION CAPABILITY OF
THE EQUIPMENTS, AS INSTALLED.

CLOSURE RATIONALE

HAZARD IS CLOSED BASED ON THE ASSURANCE THAT DEFINITION OF THE
POWER ENVIRONMENT AND COMPLIANCE THERETO OBLIVIATES THE CONDITION
UNDER WHICH THERE IS EXPOSURE TO THIS POTENTIAL HAZARD. LRU
REDUNDANCY PER MCR 955 MINIMIZES IMPACT OF THE HAZARD

HAZARD DISPOSITION CONCURRENCE

FUNCTIONAL SUPERVISION DEP-GRP	DATE	SAFETY SUPERVISION	DATE
-INTERFACE-		F.J.ATTAWAY	070775

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HA-TRACK

01/27/77 PAGE 1

HAZARD ANALYSIS NUMBER	SUBSYSTEM/EQUIPMENT OR OPERATION	LEVEL INIT	H2D TRACK	HAZARD CAT	STATUS	ENTRY DATE
1ZXX-0500-06	AVIONICS-GENERAL	CA	CN/CN	123	CONTROLLED	041974

HAZARD DESCRIPTION

SPURIOUS IGNITION SOURCES IN ORBITER AVIONIC COMPARTMENTS

FLIGHT TEST	GROUND TEST	FERRY FLIGHTS	ORBITAL MISSION	OTHER	X
ALL MISSION PHASES					
PRELAUNCH	LIFT OFF THRU ORBIT	ON ORBIT	DE-ORBIT THRU	LANDING	

HAZARD GROUP CC FIRE & EXPLOSION

RESP ENGR R.F.RAASCH

RELATED FMEAS

NONE

FMEA REQD YES NO

X

REFERENCES

SD74-SH-0223B, TABLE I , MFC004-002, MCR 2156 REV 1

HAZARD CAUSES

- 01-NON-EXPLOSION PROOFING/HERMETIC SEALING IN POSSIBLE EXPLOSIVE ATMOSPHERES
- 02-DAMAGED WIRING HARNESSSES
- 03-INADEQUATE CIRCUIT PROTECTION

HAZARD EFFECTS

POSSIBLE FIRE/EXPLOSION AND LOSS OF ORBITER & PERSONNEL

HAZARD NUMBER 1ZXX-0500-06

RELATED HAZARD ANALYSIS

1ZXX-0206-1C, 1YXX-0211-1A, 1ZXX-0506-15, 1ZXX-0506-15

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD -INTERFACE-

SAFETY LEAD W.E.PLAISTED

DISPOSITION

- 01-COMPARTMENTATION DOCUMENT
SD74-SH-0223B, TABLE I, SPELLS
OUT COMPARTMENTS AND ZONES
REQUIRING EQUIPMENT EXPLOSION
PROOFING.
02-SEE HA 1ZXX-0506-15
03-SEE HA'S 1ZXX-0506-11 AND
1ZXX-0506-13

RESP GRP ACTION DOCUMENTATION

392 SD74-SH-0223-TABLE I
REF:TABLE 3.2.1E-1
MF0004-014B

CLOSURE RATIONALE

HAZARD IS CLOSED AS ALL PROCUREMENT SPECIFICATIONS/DESIGN SPECS
AND DRAWINGS ARE SCREENED AGAINST "ENVIRONMENTAL CRITERIA SPECI-
FICATION" (MF0004-14B) AS DEFINED IN "ORBITER FIRE/TOXICITY
SAFETY REQUIREMENTS" (SD74-SH-0223B) PER MCR 2150

HAZARD DISPOSITION CONCURRENCE

FUNCTIONAL SUPERVISION DEP-GRP	DATE	SAFETY SUPERVISION	DATE
T.QUEBEDEAUX		F.J.ATTAWAY	070775

HAZARD ANALYSIS NUMBER	SUBSYSTEM/EQUIPMENT OK OPERATION	LEVEL INIT	HZD TRACK CAT	HAZARD STATUS	ENTRY DATE
1YXX-0500-07	AVIONICS GENERAL	CA	12	DELETED	012175

HAZARD DESCRIPTION

SHORT CIRCUITS IN BIOMED/COMMUNICATIONS WIRING INSIDE PRESSURE SUIT THAT CAUSE ELECTRIC SHOCK OR SUIT DAMAGE

FLIGHT TEST GROUND TEST FERRY FLIGHTS ORBITAL MISSION OTHER X
ALL MISSION PHASES WITH SUITED CREW ON-BOARD
PRELAUNCH LIFT OFF THRU ORBIT ON ORBIT DE-ORBIT THRU LANDING

HAZARD GROUP AA ELECTRICAL SHOCKRESP.ENGR. R.F.RAASCHRELATED FMEASFMEA REQD YES NO

NONE

REFERENCES

MSC 00134 REV A #226 , #227, #228

HAZARD CAUSES

- 01-LACK OF ADEQUATE FUSING & CURRENT LIMITING DEVICES TO PREVENT IGNITION OF OXYGEN-SATURATED BODY HAIR AND SKIN.
- 02-LACK OF PROTECTION OF BIOMED/COMMUNICATION UMBILICAL FROM EXTERNAL ELECTRICALLY OR THERMALLY HOT DEVICES DURING EMERGENCIES
- 03-ELECTRIC ENERGY SOURCES INSIDE SPACESUIT

HAZARD NUMBER 1YXX-0500-07

HAZARD EFFECTS

ELECTRICAL SHOCK AND POSSIBLE EQUIPMENT DAMAGE

RELATED HAZARD ANALYSIS

NONE

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD INTERFACE

SAFETY LEAD W.E.PLAISTED

DISPOSITION

RESP GRP ACTION DOCUMENTATION

SEE CLOSURE RATIONALE

45

CLOSURE RATIONALE

THIS HAZARD ANALYSIS HAS BEEN DELETED AS THE SPACESUIT IS
GOVERNMENT FURNISHED EQUIPMENT.

HAZARD ANALYSIS NUMBER	SUBSYSTEM/EQUIPMENT OR OPERATION	LEVEL INIT	HZD TRACK	HAZARD CAT	STATUS	ENTRY DATE
1ZXX-0500-08	AVIONICS-GENERAL	CR	CN/CN	12	CONTROLLED	010375

HAZARD DESCRIPTION

FAILURE OF RELAYS, QUALIFIED UNDER LAUNCH AND BOOSTER CONDITIONS
TO OPERATE UNDER QUIESCENT (VEHICLE COAST) CONDITIONS DUE TO
FRICTION INDUCED IN RELAY TO PREVENT ACTUATION BY VIBRATION

FLIGHT TEST GROUND TEST FERRY FLIGHTS ORBITAL MISSION X OTHER
PRELAUNCH X LIFT OFF THRU ORBIT X ON ORBIT X DE-ORBIT THRU LANDING

HAZARD GROUP FF LOSS OF FLIGHT CONTROL RESP ENGR R.F.RAASCH

RELATED FMEAS

FMEA REQD YES NO

05-SERIES FMEAS

X

REFERENCES

MC455-0129, MSC 60134, REV A #180, MC455-0128

HAZARD CAUSES

- 01-RELAY MAY BE CRITICAL TO OPERATION
- 02-FRICTION INDUCED IN RELAY IMPAIRS OPERATION IN ZERO "G"
CONDITION

HAZARD EFFECTS

IF NOT CORRECTABLE, COULD CAUSE ABERRATIVE CONTROL ACTIONS

RELATED HAZARD ANALYSIS

1ZXX-0506-06

4

5
4
3
2
1
0
9
8
7
6
5
4
3
2
1
0

HAZARD NUMBER 1ZXX-0500-08

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD ERNIE DEMARCHI SAFETY LEAD W.E.PLAISTED

DISPOSITION

RESP GRP ACTION DOCUMENTATION

01-RELIABILITY REDUNDANCY PROGRAM IS
APPLIED TO ORBITER DESIGN AS A
PROGRAM DISCIPLINE TO ENSURE
"FAIL OPERATIONAL" OR "FAIL SAFE"
CRITERIA IMPLEMENTATION PER
MCR-955.

394-100 MCR-955

02-COMPONENT TESTING INCLUDES RELAY
CONTACT TRANSFER UNDER VIBRATION
CONDITIONS AND CONTACT TRANSFER
UNDER NON-VIBRATION CONDITIONS
PER MC455-0128, ML455-0129

392-620 MFC004-033

CLOSURE RATIONALE

HAZARD IS CLOSED BASED ON THE ACCOMPLISHMENT OF THE RELIABILITY
AND TESTING PROGRAMS SPECIFIED IN THE CORRECTIVE ACTION ABOVE
PER MCR 955 AND MFC004-033

HAZARD DISPOSITION CONCURRENCE

FUNCTIONAL SUPERVISION DEP-GRP DATE SAFETY SUPERVISION DATE

ERNIE DEMARCHI 392-620 062075 F.J.ATTAWAY 070775

HA-TRACK

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HAZARD ANALYSIS NUMBER	SUBSYSTEM/EQUIPMENT OR OPERATION	LEVEL INIT	HZD TRACK CAT	HAZARD STATUS	ENTRY DATE
1YXX-0500-09	ELECT.PWR.DIST.& CON	CA	CN/CN	123 CONTROLLED	080874

HAZARD DESCRIPTION

PREMATURE/ FALSE INITIATION OF SEPARATION SEQUENCE(ET/SRB)

FLIGHT TEST GROUND TEST FERRY FLIGHTS X ORBITAL MISSION OTHER
Prelaunch X LIFT OFF THRU ORBIT X ON ORBIT DE-ORBIT THRU LANDING

HAZARD GROUP FF LOSS OF FLIGHT CONTROL RESP.ENGR. R.F.RAASCH

RELATED FMEAS

NONE

FMEA REQD YES NO

X

REFERENCES

MSC 00134 REV A #33, MF0004-U2U

HAZARD CAUSES

- 01-SEPARATION SENSORS TRIGGERED BY STRUCTURE DEFLECTION
- 02-SEPARATION SIGNAL GENERATED BY SYSTEM MALFUNCTION
- 03-INADVERTENT ACTUATION

HAZARD EFFECTS

LOSS OF PERSONNEL OR VEHICLE. WORST CASE

RELATED HAZARD ANALYSES

1Y3X-0203-01A, 1Y3X-0203-2A, 1Y3X-0207-13b, 1Y3X-0207-14b

HAZARD NUMBER 1YXX-0500-C9

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD KEN NICHOLS

SAFETY LEAD W.E.PLAISTED

DISPOSITION

01-SEPARATION SENSORS NOT PART
OF DESIGN

RESP GRP ACTION DOCUMENTATION

396-610 NONE REQUIRED

02-SHORT CIRCUIT IMMUNE CIRCUITRY
& MULTISEQUENCE, SERIAL INITIATED
SYSTEM TO BE PROVIDED

396-610 MC450-0018

03-PROVIDE GUARDED SWITCHES

396-610 VL70-730102

CLOSURE RATIONALE

HAZARD IS CLOSED AS THE SELECTION OF DESIGN OPTIONS HAS
NEGATED THE POSSIBILITY OF THE CITED CAUSES OCCURRING,
PER MC450-0018 AND VL70-730102

HAZARD DISPOSITION CONCURRENCE

FUNCTIONAL SUPERVISION	DEP-GRP	DATE	SAFETY SUPERVISION	DATE
L.A.UPEEGRAFF	392-610	002075	F.J.ATTAWAY	070775

HA-TRACK

01/27/77 PAGE 1

HAZARD ANALYSIS NUMBER	SUBSYSTEM/EQUIPMENT OR OPERATION	LEVEL INIT	HZD TRACK	CAT	HAZARD STATUS	ENTRY DATE
1ZXX-0501-01	GUIDANCE-NAVIGATION	CA		1c	DELETED	091873

HAZARD DESCRIPTION

ATTITUDE INDICATOR GIVES FALSE READING TO PILOT & MANUAL OVERRIDE
INITIATED (SEE HA 1AXX-0503-25)

HA-TRACK

01/27/77 PAGE 1

HAZARD ANALYSIS SUBSYSTEM/EQUIPMENT NUMBER	LEVEL OR OPERATION	INIT	HZD TRACK	HAZARD CAT	STATUS	ENTRY DATE
12XX-0501-02	GUIDANCE-NAVIGATION	CR	CN/CN	12	CONTROLLED	092371

HAZARD DESCRIPTION

LOSS OF IMU PLATFORM STABILITY

FLIGHT TEST X GROUND TEST FERRY FLIGHTS ORBITAL MISSION X OTHER
PRELAUNCH LIFT OFF THRU ORBIT X ON ORBIT X DE-ORBIT THRU LANDING X

HAZARD GROUP FF LOSS OF FLIGHT CONTROL RESP. ENGR R.RAASCH

RELATED FMEAS

FMEA REQD YES NO

NONE

X

REFERENCES

MC409-0004, MSC UC134 REV A, ITEM 26; MSCI 3080 DPS#16

HAZARD CAUSES

- 01-POWER INTERRUPTION/LIGHTNING STRIKE
- 02-IMPROPER GYRO ROTATIONAL SPEEDS
- 03-CATASTROPHIC FAILURE OF UNIT

HAZARD EFFECTS

ISSUANCE OF UNWANTED/UNCONTROLLABLE DISCRETES COULD CAUSE LOSS OF GEN DATA UPDATE AND LOSS OF VEHICLE

RELATED HAZARD ANALYSES

NONE

SDS-II-0001-06

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HAZARD NUMBER 1ZXX-0501-02

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD C.P.MORAN	SAFETY LEAD W.E.PLAIESTED
DISPOSITION	RESP GRP ACTION DOCUMENTATION
01-POWER FROM MULTIPLE 28 VDC BUS SEGMENTS VS70-710101	392-610 VS70-710101
02-FDI/BITE ASSESSES VALIDITY OF SYSTEMS PER MC409-0004 PARA 3.2.1.3.1.(BITE) AND RI- SINGER SOW PARA 3.1.(FDI)	392-230 MC409-0004
03-TRIPLE REDUNDANT SYSTEM PER VL70-000265 (FO/FS)	392-230 VS70-710101
01-03 PROVIDE REDUNDANT IMU AND SELECTION CRITERIA PER SD74-SH- 0270A "...REDUNDANCY MGT/MODING SEQUENCING & CONTROL	382-300 SD74-SH-0270A

CLOSURE RATIONALE

HAZARD IS CLOSED BASED ON THE POWER REDUNDANCY, FUNCTIONAL
REDUNDANCY AND ASSESSMENT OF CAPABILITY OF THE SUBSYSTEM AS
ACCOMPLISHED IN THE CORRECTIVE ACTION ABOVE

HAZARD DISPOSITION CONCURRENCE

FUNCTIONAL SUPERVISION DEP-GRP	DATE	SAFETY SUPERVISION	DATE
-INTERFACE-		F.J.ATTAWAY	070775

HA-TRACK

01/27/77 PAGE 1

HAZARD ANALYSIS SUBSYSTEM/EQUIPMENT NUMBER	OR OPERATION	LEVEL INIT	HLD TRACK	HAZARD STATUS	ENTRY DATE
1ZXX-0501-03	GUIDANCE-NAVIGATION	CA	CN/CN 12	DELETED	092073

HAZARD DESCRIPTION

PYROTECHNIC ACTUATION IN ERROR (SEE HA:1A6X-0506-02)

HA-TRACK

02/04/77 PAGE 1

HAZARD ANALYSIS SUBSYSTEM/EQUIPMENT NUMBER	CR OPERATION	LEVEL INIT	HLD TRACK LAT	HAZARD STATUS	ENTRY DATE
1YXX-0501-04	GUIDANCE-NAVIGATION	CR	CR/CN 2	IN-WORK	082974

HAZARD DESCRIPTION

FALSE LOCK-IN/UNLOCK OF STAR TRACKER OPTICS

FLIGHT TEST GROUND TEST FERRY FLIGHTS ORBITAL MISSION X OTHER
PRELAUNCH LIFT OFF THRU CRIT IN CRIT X DE-ORBIT THRU LANDING

HAZARD GROUP FF LOSS OF FLIGHT CONTROL RESP. EGNR. R.F.RAASCH

RELATED FMEAs

NONE

FMEA REQD YES NO

X

REFERENCES

MSL-00134 REV A, ITEM 157

HAZARD CAUSES

- 01-FALSE STARS(ILLUMINATED LOCAL CONTAMINANTS)
- 02-LOCK-IN SENSITIVITY THRESHOLD ANMLLY
- 03-UNCATALLUED STAR

HAZARD EFFECTS

IMPROPER SLEWING SIGNALS TO GYROS COULD CAUSE LOSS OF ABILITY TO
ACHIEVE DESIRED LANDING SITE DUE TO ERRORS AT ENTRY INTERFACE.
INCORRECT FLIGHT PATH ANGLE COULD RESULT IN EXCESSIVE HEATING
AT ENTRY

HAZARD NUMBER 1YXX-0501-04

RELATED HAZARD ANALYSES

1YXX-0501-02

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD PETE TANNER

DISPOSITION

01-03 REQUIRE PERIODIC TESTS
AGAINST IMU POSITION
REQUIRE PERIODIC DRIFT/RATE
CHECK
REQUIRE PERIODIC MAGNITUDE
CHECK
04-REQUIRE INITIAL STAR ID

SAFETY LEAD W.E. PLAISTED

RESP GRP	ACTION DOCUMENTATION
352-230	SAIL TESTING
	SAIL TESTING
	SAIL TESTING
	FLIGHT DATA FILE PROCEDURES

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OF POOR QUALITY

SD77-SII-0001-06

HAZARD ANALYSIS NUMBER	SUBSYSTEM/EQUIPMENT OR OPERATION	LEVEL INIT TRACK	HZD CAT	HAZARD STATUS	ENTRY DATE
1YXX-0501-06	GUIDANCE-NAVIGATION	CA	CN/CN 12	CONTROLLED	082974

HAZARD DESCRIPTIONINABILITY TO ACCESS TAEMS

FLIGHT TEST X GROUND TEST	FERRY FLIGHTS	OREITAL MISSION X OTHER
PRELUNCH LIFT OFF THRU ORBIT	ON ORBIT	DE-ORBIT THRU LANDING X

HAZARD GROUP FF LOSS OF FLIGHT CONTROL	RESP. ENGR R.RAASCH
--	---------------------

RELATED FMEASFMEA REQD YES NCNONE

X

REFERENCESPHASE "B" HA#1.1-01,-15,-16&-23;MSC-00134 REV A, ITEM 172HAZARD CAUSES

- 01-WEATHER(APPROACH & LANDING)
- 02-INABILITY TO POSITION VEHICLE IN MSBLS ANTENNA PATTERN
- 03-LOSS OF MSBLS CAPABILITY
- 04-INTERFACE-IMPROPER ATTITUDE & POSITION DATA FROM STAR TRACKER
- 05-LACK OF MSBLS OR OTHER LANDING AIDS AT CONTINGENCY LANDING SITE.

HAZARD EFFECTS

LOSS OF VEHICLE AND PERSONNEL DUE TO ENERGY DEPLETION. IMPROPER ENTRY ATTITUDE POSITIONING, OR OTHER FACTORS INTERFERING WITH APPROACH & LANDING

HAZARD NUMBER 1YXX-0501-06

RELATED HAZARD ANALYSES

04-1ZXX-0501-02; 1YXX-0501-04, 1ZXX-0501-08

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD JOE MURRAY	SAFETY LEAD W.E. PLAISTED
DISPOSITION	RESP GRP ACTION DOCUMENTATION
01-PROVIDE ALL WEATHER LANDING CAPABILITY PER VL70-000265 (TACAN,RADAR ALT., MSBLS WITH C&S-BANDS RADAR BACK-UP)	392-420 VL70-000265 430
02-DEVELOP TERMINAL AREA ENERGY MANAGEMENT TECHNIQUES(TAEM)	390-400 ALT FLIGHTS
03-SAME AS 01-ABOVE	
05-DEVELOP TERMINAL AREA ENERGY MANAGEMENT TECHNIQUES FOR CONTINGENCY LANDING SITES.	ALT FLIGHTS

CLOSURE RATIONALE

HAZARD IS CLOSED BASED ON DEMONSTRATION OF TAEM TECHNIQUES IN THE ALT FLIGHT TEST PROGRAM AND THE STA TAEM DEVELOPMENT FLIGHT TEST PROGRAM

HAZARD DISPOSITION CONCURRENCE

FUNCTIONAL SUPERVISION DEP-GRP	DATE	SAFETY SUPERVISION	DATE
-INTERFACE-		F.J. ATTAWAY	

HAZARD ANALYSIS NUMBER	SUBSYSTEM/EQUIPMENT OR OPERATION	LEVEL INIT	HZD TRACK	HAZARD CAT	STATUS	ENTRY DATE
1ZXX-0501-07	FLIGHT CONTROL	CR	CN/CN	12	CONTROLLED	091974

HAZARD DESCRIPTION

LOSS OF RATE GYRO STABILITY

FLIGHT TEST X GROUND TEST FERRY FLIGHTS ORBITAL MISSION X OTHER
PRELAUNCH LIFT OFF THRU ORBIT X ON ORBIT X DE-ORBIT THRU LANDING X

HAZARD GROUP FF LOSS OF FLIGHT CONTROL RESP. ENGR R.RAASCH

RELATED FMEAS

FMEA REQD YES NO

NONE

X

REFERENCES

MC493-0015; MSC-00134 REV A, ITEM 26; MSCI 8080, DPS#6

HAZARD CAUSES

- 01-POWER INTERRUPTION/LIGHTNING STRIKE
- 02-IMPROPER GYRO ROTATIONAL SPEEDS
- 03-LOSS OF SENSE DATA
- 04-IMPROPER FREQUENCY RESPONSE

HAZARD EFFECTS

LOSS OF STABILITY REFERENCE COULD CAUSE LOSS OF ORBITER VEHICLE
AND CREW IF ALL GYRO ASSEMBLIES FAIL

HAZARD NUMBER 1ZXX-0501-07

RELATED HAZARD ANALYSES

1ZXX-0501-02

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD	W.TALBOTT	SAFETY LEAD	W.E.PLAISTED
DISPOSITION		RESP GRP	ACTION DOCUMENTATION
01-POWER FROM MULTIPLE 26VDC BUS SEGMENTS PER	VS70-790581, SHT 3	392-610	VS70-790581
02-INCORPORATE SPIN MOTOR ROTATION DETECTORS (SMRDS) PER	MC493-0015	392-230	MC493-0015
03-PROVIDE REDUNDANT RATE GYRO & SELECTION CRITERIA (BITE IS PROVIDED IN CURRENT DESIGN)	392-300	SD74-SH-0270A REF:MCR 3915	
04-SAME AS 03 ABOVE			

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CLOSURE RATIONALE

HAZARD IS CLOSED BASED ON THE POWER REDUNDANCY, FUNCTIONAL REDUNDANCY AND ASSESSMENT OF CAPABILITY OF THE SUBSYSTEM AS ACCOMPLISHED IN THE CORRECTIVE ACTION ABOVE

HAZARD DISPOSITION CONCURRENCE

FUNCTIONAL SUPERVISION DEP-GRP	DATE	SAFETY SUPERVISION	DATE
-INTERFACE-		F.J.ATTAWAY	070775

SD74-SH-0001-06

HA-TRACK

01/27/77 PAGE

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HAZARD ANALYSIS NUMBER	SUBSYSTEM/EQUIPMENT OR OPERATION	LEVEL INIT	HZD TRACK CAT	HAZARD STATUS	ENTRY DATE
1YXX-0501-08	GUIDANCE/NAVIGATION	CR	CN/CN 12	CONTROLLED	121374

HAZARD DESCRIPTION

LOSS OF GUIDANCE SYSTEM ACCURACY

FLIGHT TEST GROUND TEST FERRY FLIGHTS ORBITAL MISSION X OTHER
PRELAUNCH LIFT OFF THRU ORBIT X ON ORBIT X DE-ORBIT THRU LANDING X

HAZARD GROUP FF LOSS OF FLIGHT CONTROL RESP.ENGR. R.F.RAASCH

RELATED FMEAS

NONE

FMEA REQD YES NO

X

REFERENCES

MSC 00134 REV A #172

HAZARD CAUSES

- 01-WARPAGE OF NAV BASE STRUCTURE
- 02-IMPROPERLY KEYED ACCELEROMETERS
- 03-ERRONEOUS IMU UPDATE
- 04-REINSTALLATION OF IMU'S WITH PROTRUSIONS UNDER IMU PADS
- 05-DAMAGE TO NAV BASE STRUCTURE

HAZARD EFFECTS

LOSS OF GUIDANCE ACCURACY, IF UNDETECTED , COULD LEAD TO LOSS OF VEHICLE AND PERSONNEL

60

90-1000-HSS-2205

HAZARD NUMBER 1YXX-0501-08

RELATED HAZARD ANALYSES1ZXX-0501-02HAZARD IDENTIFICATION CONCURRENCEFUNCTIONAL LEAD C.P.MORANSAFETY LEAD W.E.PLAIESTEDDISPOSITIONRESP GRP ACTION DOCUMENTATION

01-STRUCTURE/VIBRATION TESTING
PLANNED IN THERMAL ENVIRON-
MENTS PER STRUCTURAL TEST
C-30.

QUALIFICATION TESTS
PROCEDURE

02-CALIBRATION TESTS AT MFG AND
IN USER'S FACILITY PRECLUDE
GROSS INSTALLATION MISALIGN-
MENT FROM BEING UNDETECTED
03-REDUNDANCY MANAGEMENT CRITERIA
VOTING LOGIC COMPARES IMU UP-
DATE DATA PER SD-74-SH-0270A
LEVEL "C" PART "D"

MCR 3930
TEST & CHECKOUT
PROCEDURE

04-REQUIRES TEST & CHECKOUT
PROCEDURES TO CHECK ON PAD &
NAV BASE PROTRUSION THAT COULD
CAUSE ERRONEOUS IMU ALIGNMENT.
05-PERIODIC NAV BASE CALIBRATION
REQUIRED

ADL/SAIL CHECKOUT
PROCEDURE

TEST & CHECKOUT
PROCEDURE

TEST & CHECKOUT
PROCEDURE

CLOSURE RATIONALE

HAZARD IS CLOSED BASED ON THE ACCOMPLISHMENT OF TESTS IN ADL/SAIL
AND THE CORRECTIVE ACTIONS ABOVE.

HAZARD ANALYSIS NUMBER	SUBSYSTEM/EQUIPMENT OR OPERATION	LEVEL INIT	HZD TRACK	CAT	HAZARD STATUS	ENTRY DATE
IYXX-0501-09	GUIDANCE/NAVIGATION	CA	CA	123	RESIDUAL	080274

HAZARD DESCRIPTION

REDUNDANT PATHS NOT ADEQUATELY SEPARATED - IMU'S COLOCATED

FLIGHT TEST GROUND TEST FERRY FLIGHTS ORBITAL MISSION X OTHER
PRELAUNCH LIFT OFF THRU ORBIT X ON ORBIT X DE-ORBIT THRU LANDING X

HAZARD GROUP FF LOSS OF FLIGHT CONTROL RESP.ENGR. R.F.RAASCH

RELATED FMEAS

NONE

FMEA REQD YES NO

X

REFERENCES

MSC-00134 REV A #4, MC409-0004

HAZARD CAUSES

01-CASCADING INTERNAL SHRAPNEL ADJACENT DESTRUCTIVE EFFECTS
02-LOSS OF COOLING AIR - SINGLE HEAT EXCHANGER, SINGLE PLENUM

HAZARD EFFECTS

SINGLE COMPARTMENT INCIDENT COULD CAUSE LOSS OF GUIDANCE/NAV
CAPABILITY AND SUBSEQUENT LOSS OF VEHICLE AND PERSONNEL

HAZARD NUMBER 1YXX-0501-09

RELATED HAZARD ANALYSES

NONE

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD C.P.MORAN

SAFETY LEAD W.E.PLAISTED

DISPOSITION

SEE DISPOSITION RATIONALE

RESP GRP ACTION DOCUMENTATION

DISPOSITION RATIONALE

THIS HAZARD IS RESIDUAL IN THAT A SINGLE COMPARTMENT DAMAGING EVENT WOULD BE CATASTROPHIC. HORIZONTAL ALIGNMENT CONSTRAINTS DICTATE IMU COLLOCATION TO ACHIEVE REQUIRED ACCURACIES. IMU'S SHARE CABIN ENVIRONMENT AND ENJOY THE SAME FD/FS REDUNDANCY AS THE CREW AND, AS SUCH, ARE EXPOSED TO THE SAME RISK LEVEL AS THE CREW

HA-TRACK

02/09/77 PAGE 1

HAZARD ANALYSIS NUMBER	SUBSYSTEM/EQUIPMENT OR OPERATION	LEVEL INIT	HLD TRACK	HAZARD STATUS	ENTRY DATE
1AXX-0501-11	GUIDANCE-NAVIGATION	CA	CN/CN	2 CONTROLLED	082974

HAZARD DESCRIPTION

IMPROPER AIR DATA INPUTS OR LOSS OF AIR DATA INPUTS

FLIGHT TEST X GROUND TEST FERRY FLIGHTS ORBITAL MISSION OTHER
PRELAUNCH LIFT OFF THRU ORBIT IN ORBIT DE-COOrT THRU LANDING X

HAZARD GROUP FF LOSS OF FLIGHT CONTROL RESP.ENGR. R.F.RAASCH

RELATED FMEAs

05-1-GN28-1

FMEA REQD YES NO

X

REFERENCES

PHASE "B" #1.1-1c, MPMA A-16.4, IL3E3-10C-JBP-76-L18

HAZARD CAUSES

O1-AIR DATA SYSTEM NOT CALIBRATED
O2-PROBES NOT DEPLOYED

HAZARD EFFECTS

WITHOUT ACCURATE AIR DATA, THE VEHICLE COULD BE LOST FROM:
OVERSTRESSING, MISSING LANDING POINT, CRASH LANDING FOLLOWING
STALL, AND OVERRUNNING RUNWAY

RELATED HAZARD ANALYSES

12XX-0204-02-01, 12XX-1209-02-02, 1AXX-0501-05

HAZARD NUMBER 1YXX-0501-11

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD -INTERFACE-

DISPOSITION

01602-NAV DERIVED AIR DATA CPS
IS BEING EXTENDED FROM 300,000
FT DOWN TO GROUND LEVEL

SAFETY LEAD W.E.PLASIFED

RESP GRP ACTION DOCUMENTATION

383-100 1L5E3-100-JBP-76-018
DTD 14 SEP 76

SOFTWARE CONFIGURED TO ACCEPT
ALTITUDE UPDATE

"

APPLICATION PROGRAMS ARE DE-
SENSITIZE THEMSELVES TO IN-
ACCURATE AIR DATA: NAV LOCKS
OUT BARO ALTIMETER INPUT IN
TRANSONIC REGION

"

PLACARD INITIAL DFT FLTS FOR
LIMITED WIND CONDITIONS

394-400 1L594-400-76-102, DTD
5 OCT 76

65

CLOSURE RATIONALE

HAZARD IS CLOSED AS PRECAUTIONS ARE BEING TAKEN TO DISALLOW
EXPOSURE THROUGH THE CAUSES NOTED (REF: NOTED DOCUMENTS)

HAZARD DISPOSITION CONCURRENCE

FUNCTIONAL SUPERVISION DEP-GRP DATE SAFETY SUPERVISION DATE

SD77-SH-0001-06

ORIGINAL PAGE IS
OF POOR QUALITY

HA-TRACK

01/27/77 PAGE

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HAZARD ANALYSIS SUBSYSTEM/EQUIPMENT NUMBER	LEVEL OR OPERATION	INIT TRACK	HZD CAT	HAZARD STATUS	ENTRY DATE
1YXX-0501-12	GNCC	CA	CN/CN	012 CONTROLLED	071276

HAZARD DESCRIPTION

EXCEEDING LIMIT LOAD FACTORS DURING ENTRY/MINI-ENTRY

FLIGHT TEST	GROUND TEST	FERRY FLIGHTS	ORBITAL MISSION	OTHER
PRELAUNCH	LIFT OFF THRU ORBIT	ON ORBIT	DE-ORBIT THRU	LANDING X

HAZARD GROUP FF LOSS OF FLIGHT CONTROL RESP.ENGR. R.F.RAASCH

RELATED FMEAS

SEE RELATED HA'S

FMEA REQD YES NO

X

REFERENCES

RTLS MPHA

HAZARD CAUSES

- 01-LOSS OF OR IMPROPER LOAD LIMITS AND/OR DISPLACEMENTS
- 02-FAILURE OF BALLISTIC CONTROL SYSTEM
- 03-FAILURE OF AERO CONTROL SYSTEM
- 04-STRUCTURAL HEATING BEYOND ALLOWABLES

HAZARD EFFECTS

BREAKUP OF AND/OR LOSS OF VEHICLE THROUGH OFF-DESIGN AERO-THERMAL LOADS EFFECTS.

RELATED HAZARD ANALYSES

02-1YXX-0302-SERIES; 03-1ZXX-0209-SERIES; 04-1ZXX-0100-SERIES

HAZARD NUMBER 1YXX-0501-12

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD -INTERFACE-

SAFETY LEAD W.E.PLAISTED

DISPOSITION

01&04-ESTABLISH "NOT TO EXCEED"
ALPHA LIMITS IN OSOP PER
SD73-SH-0178-1C FOR ALPHA,
DYNAMIC PRESSURE, "G" LOADING
IN ALL AXES

RESP GRP ACTION DOCUMENTATION

394-400 IL394-400-76-161

PROVIDE MEANS TO DETERMINE
LOAD FACTORS

BASELINE-INSTL OF
ACCELEROMETERS
IN INSTR. PANEL

02&03-F0/FS (PFCS/EFCS) SYSTEMS

BASELINE ON OV-102

CLOSURE RATIONALE

THIS HAZARD IS CLOSED AS PILOT MONITORING OF AUTOMATIC FUNCTIONS
IS PROVIDED THROUGH PANEL INSTALLED ACCELEROMETERS, OPERATIONAL
CAUTIONS WARNINGS AND NOTES ARE TO APPEAR IN THE OV-102 DATA
FILE, AND MULTIPLE FAILURE TOLERANT CONTROL SYSTEMS ARE
PROVIDED

HAZARD DISPOSITION CONCURRENCE

FUNCTIONAL SUPERVISION DEP-GRP	DATE	SAFETY SUPERVISION	DATE
-INTERFACE-		F.J. ATTAWAY	

HA-TRACK

01/27/77 PAGE

1

HAZARD ANALYSIS NUMBER	SUBSYSTEM/EQUIPMENT OR OPERATION	LEVEL INIT	HZD CAT	HAZARD STATUS	ENTRY DATE
1YXX-0501-13	GNEC	CA CA	012	IN WORK	081276

HAZARD DESCRIPTION

FAILURE TO INITIATE POST ET SEPARATION ORBITER PITCH-UP DURING
RTLS ABORT

FLIGHT TEST X GROUND TEST FERRY FLIGHTS ORBITAL MISSION OTHER
PRELAUNCH LIFT OFF THRU ORBIT X ON ORBIT DE-ORBIT THRU LANDING X

HAZARD GROUP FF LOSS OF FLIGHT CONTROL RESP.ENGR. R.F.RAASCH

RELATED FMEAS

NONE

FMEA REQD YES NO

X

REFERENCES

RTLS MPFA, MG036100-SERIES

HAZARD CAUSES

- 01-GENERIC SOFTWARE FAULT
- 02-BALLISTIC/AERO CONTROL FAILURE

HAZARD EFFECTS

THERMAL LOAD EFFECTS.
BREAK-UP OF AND/OR LOSS OF VEHICLE THROUGH OFF DESIGN AERO-

RELATED HAZARD ANALYSES

1YXX-0505-02

89

SDS-II-S-000-000-000

HAZARD NUMBER 1YXX-0501-13

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD -INTERFACE-

DISPOSITION

01-BACK UP TO BE PROVIDED FOR
GENERIC SOFTWARE FAULT

CREW SHOULD BE ALERTED TO
PITCH-UP REQUIREMENT IN OFT
DATA FILE

02-MULTIPLE REDUNDANCY OF BOTH
AERO & BALLISTIC CONTROL
SYSTEMS PROVIDES CONFIDENCE
THAT FUNCTIONS WILL BE AVAIL-
ABLE WHEN NEEDED

SAFETY LEAD W.E.PLAISTED

RESP GRP ACTION DOCUMENTATION

(NOT BASELINED)

IL394-400-76-161 DTC
5 OCT 76

ORBITER BASELINE

69

SDS-277-SH-0001-06

HAZARD ANALYSIS NUMBER	SUBSYSTEM/EQUIPMENT OR OPERATION	LEVEL INIT	H2D TRACK CAT	HAZARD STATUS	ENTRY DATE
1ZXX-0501-15	GNCC	CA	CA	IN-WORK	091476

HAZARD DESCRIPTION

PREMATURE NOSE PITCH DOWN AT ROUND OUT - AUTOLAND MODE ONLY

FLIGHT TEST GROUND TEST FERRY FLIGHTS ORBITAL MISSION OTHER
PRELAUNCH LIFT OFF THRU ORBIT ON ORBIT DE-ORBIT THRU LANDING X

HAZARD GROUP FF LOSS OF FLIGHT CONTROL RESP.ENGR. R.F.RAASCH

RELATED FMEAS FMEA REQD YES NO

REFERENCESHAZARD CAUSES

01-FAILURE OF WOW CIRCUITRY AT ROUND OUT

HAZARD EFFECTS

FAILED WOW CIRCUITRY AT ROUND OUT MAKES SOFTWARE BELIEVE THAT
THE ORBITER HAS TOUCHED DOWN AND PREMATURE NOSE PITCH DOWN
OCCURS, CAUSING POSSIBLE CRASH LANDING WITH DAMAGE TO VEHICLE
AND INJURY OR LOSS OF CREW

RELATED HAZARD ANALYSES

HAZARD NUMBER 12XX-0501-15

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD -INTERFACE-

DISPOSITION

ON OV-101 WOW CIRCUITRY IS MONITORED BY TM & CREW IS ADVISED OF SYSTEM INTEGRITY BY VOICE FROM GROUND - IF FAULTED, GO MANUAL

ON OV-102 SYSTEM DESIGN IS NOT RESOLVED AS TO HOW TO AVOID EXPOSURE TO PROBLEM

SAFETY LEAD W.E.PLAISTED

RESP GRP ACTION DOCUMENTATION

HAZARD ANALYSIS NUMBER	SUBSYSTEM/EQUIPMENT OR OPERATION	LEVEL INIT	HZD TRACK CAT	HAZARD STATUS	ENTRY DATE
1YXX-0501-50	FLIGHT CONTROL	CA	CN/CN 12	CONTROLLED	080874

HAZARD DESCRIPTION

FALSE INITIATION OF AUTO SHUTDOWN OF SSME'S

FLIGHT TEST GROUND TEST FERRY FLIGHTS ORBITAL MISSION OTHER
PRELAUNCH LIFT OFF THRU ORBIT X ON ORBIT DE-ORBIT THRU LANDING

HAZARD GROUP FF LOSS OF FLIGHT CONTROL RESP.ENGR. R.F.RAASCH

RELATED FMEAS

NONE - SEE MCR 0274

FMEA REQD YES NO

REFERENCES

MSCI 8080 DPS#4B, MSC 00134 REV A #34, MCR 0274 REV A
SD75-SH-0064-CUNCR #17

HAZARD CAUSES

- 01-EMI(LIGHTNING/TRANSIENT SIGNAL INDUCTION)
- 02-LOCK-OUT MALFUNCTION (ELECTROMECHANICAL INTERFACES)
- 03-POWER INTERRUPTION
- 04-ENGINE KILL CIRCUITY LIVE AFTER HOLDOWN RELEASE

HAZARD EFFECTS

IF BEYOND ABORT CAPABILITY, LOSS OF VEHICLE AND PERSONNEL

HAZARD NUMBER 1YXX-0501-50

RELATED HAZARD ANALYSES

1ZXX-0500-04

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD -INTERFACE-

SAFETY LEAD W.E.PLAISTED

DISPOSITION

PROVIDE ASSURANCE THAT LIGHTNING
& SNEAK CIRCUIT ASSESSMENT WILL
ADDRESS HAZARD CAUSES.

RESP GRP ACTION DOCUMENTATION

CLOSURE RATIONALE

THIS HAZARD IS CLOSED AS SNEAK CIRCUIT EFFORT AND PLANNED NON-
DESTRUCTIVE LIGHTNING TESTING BOTH ADDRESS THE CAUSES OF THE
HAZARD.

HA-TRACK

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HAZARD ANALYSIS NUMBER	SUBSYSTEM/EQUIPMENT OR OPERATION	LEVEL INIT	MZD TRACK	HAZARD CAT	HAZARD STATUS	ENTRY DATE
1ZXX-0501-52	FLIGHT CONTROL				DELETED	080674

HAZARD DESCRIPTION

FLIGHT CONTROL COMPUTER OUTPUT ERROR(SEE HA'S 1YXX-0507-04 & -05)

HA-TRACK

01/27/77 PAGE 1

HAZARD ANALYSIS SUBSYSTEM/EQUIPMENT NUMBER	LEVEL OR OPERATION	INIT TRACK CAT	HAZARD STATUS	ENTRY DATE
1YXX-0501-53	FLIGHT CCNTROL		DELETED	080674

HAZARD DESCRIPTION

SELECTED MULTIPLE FAILURES OF ATTITUDE CONTROL DRIVER UNITS
FUNCTION (SEE HA'S 1YXX-0507-04 & -05)

75

90-1000-HS-22GS

HA-TRACK

01/27/77 PAGE 1

HAZARD ANALYSIS NUMBER	SUBSYSTEM/EQUIPMENT OR OPERATION	LEVEL INIT	HZD CAT	HAZARD STATUS	ENTRY DATE
1YXX-0501-54	FLIGHT CONTROL SYS	CA	LN/LN 123	CONTROLLED	021375

HAZARD DESCRIPTION

FAILURE TO OBTAIN A FINAL END-TU-END CHECK OF SHUTTLE VEHICLE
CONTROL AND STABILIZATION SYSTEMS IN THE LAUNCH CONFIGURATION

FLIGHT TEST	GROUND TEST	FERRY FLIGHTS	ORBITAL MISSION	OTHER
PRELAUNCH X	LIFT OFF THRU ORBIT X	ON ORBIT	DE-ORBIT THRU	LANDING X

HAZARD GROUP FF LOSS OF FLIGHT CONTROL RESP.ENGR. R.F.RAASCH

RELATED FMEAS

NONE

FMEA REQD YES NO

X

REFERENCES

MSC 00134 REV A #142

HAZARD CAUSES

NO REQUIREMENT FOR END TO END CHECKOUT

HAZARD EFFECTS

POSSIBLE LOSS OF VEHICLE AND PERSONNEL DUE TO FCS MALFUNCTION

RELATED HAZARD ANALYSIS

NONE

HAZARD NUMBER 1YXX-0501-54

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD PAUL GARCIA

SAFETY LEAD W.E.PLAISTED

DISPOSITION

RESP GRP ACTION DOCUMENTATION

END-TO-END TEST REQUIRMNT SPECIFICATION DOCUMENT (TRSD) ML 0101-0001 IS TO EXERCISE THE FLIGHT CONTROL SYSTEM

TEST REQ SPEC DOC
ML0101-0001
REF:MCR-3444

CLOSURE RATIONALE

THIS HAZARD IS CLOSED AS THE NOTED TEST DOCUMENT INCORPORATES THE NEEDED TEST REQUIREMENT

HA-TRACK

01/27/77 PAGE

1

HAZARD ANALYSIS NUMBER	SUBSYSTEM/EQUIPMENT OR OPERATION	LEVEL INIT	HZD TRACK	HAZARD CAT	STATUS	ENTRY DATE
IYXX-0501-55	FLIGHT CONTROL SYST.	CR	CN/CN	12	DELETED	012175

HAZARD DESCRIPTION

DOCKING WITHOUT DEACTIVATING INCOMPATIBLE VEHICLE STABILIZATION SYSTEMS

FLIGHT TEST GROUND TEST FERRY FLIGHTS ORBITAL MISSION OTHER
PRELAUNCH LIFT OFF THRU ORBIT ON ORBIT X DE-ORBIT THRU LANDING

HAZARD GROUP FF LOSS OF FLIGHT CONTROL RESP ENGR R.F.RAASCH

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RELATED FMEAS FMEA REQD YES NO

NONE X

REFERENCES

MSC 00135 REV A #250

S
001-1000-II-SII-2221-1

HAZARD CAUSES

01-SEVERE OSCILLATIONS RESULTING FROM CHANGE IN VEHICLE MASS OR
DIFFERENCES IN STABILIZATION SYSTEM RESPONSE CHARACTERISTICS
02-LACK OF MEANS TO DEACTIVATE SYSTEMS IN PASSIVE VEHICLE -
PARTICULARLY ON RESCUE OF INCAPACITATED CREW

HAZARD EFFECTS

DAMAGE TO ONE OR BOTH VEHICLES ENOUGH TO IMPAIR RETURN OF EITHER
OR BOTH VEHICLES AND CREW

HAZARD NUMBER 1YXX-0501-55

RELATED HAZARD ANALYSIS

NONE

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD -INTERFACE-

SAFETY LEAD W.E.PLAISTED

DISPOSITION

CHARACTERISTICS OF OTHER SPACE
ACTIVE SYSTEMS TO BE REVIEWED
WHEN AVAILABLE AND/OR WHEN
IDENTIFIED

RESP GRP ACTION DOCUMENTATION

CLOSURE RATIONALE

HAZARD IS DELETED AS DOCKING MODULE RELATED HAZARDS ARE NOT
BEING ADDRESSED.

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SD27-SII-0001-06

HAZARD ANALYSIS NUMBER	SUBSYSTEM/EQUIPMENT OR OPERATION	LEVEL INIT	HZD TRACK CAT	HAZARD STATUS	ENTRY DATE
1ZXX-0501-57	FLIGHT CONTROLS SYS	CA	CN/CN 123	CONTROLLED	101575

HAZARD DESCRIPTION

FAILURE OF MDM TO PROVIDE A DISABLE SIGNAL WHEN THE BODY FLAP IS BEING DRIVEN

FLIGHT TEST X GROUND TEST FERRY FLIGHTS ORBITAL MISSION OTHER
PRELAUNCH LIFT OFF THRU ORBIT ON ORBIT DE-ORBIT THRU LANDING X

HAZARD GROUP FF LOSS OF FLIGHT CONTROL RESP ENGR R.F.RAASCH

RELATED FMEAS FMEA REQD YES NO

ALT FCS FMEA & CIL SD75-SH-0193 - 12 SEP 75 X

REFERENCES

SD74-SH-0066

HAZARD CAUSES

ONLY ONE MDM (MDM FA-2 PRIME) IS USED AT A TIME TO DRIVE THE BODY FLAP.

HAZARD EFFECTS

BODY FLAP DRIVE, IF NOT DISABLED WHEN REQUIRED, COULD DRIVE BODY FLAP TO EXTREME POSITION NOT COMPATIBLE WITH FLIGHT PROFILE REQUIREMENTS - LOSING VEHICLE AND CREW

HAZARD NUMBER 1ZXX-0501-57

RELATED HAZARD ANALYSIS

NONE

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD -INTERFACE-

SAFETY LEAD W.E.PLAISTED

DISPOSITION

FOR OV-101, SOFTWARE PACKAGE IS
DEVELOPED TO DETECT RUNAWAY
BODY FLAP THROUGH A POSITION HOLD
LOOP IF MDM CHANNEL LOCKOUT
OCCURS, ALLOWING EVENTUAL
SHUTDOWN OF MDM

RESP GRP ACTION DOCUMENTATION

CHANGE REQUEST
(SFTWR DES REV)
CR#1522

FOR OV-102, A CREW ACCESSIBLE
ENGAGE RESET OVERRIDE IS TO BE
PROVIDED

1L344-400-76-101

CLOSURE RATIONALE

THIS HAZARD IS CLOSED BASED ON THE CORRECTIVE ACTION NOTED
ABOVE.

HAZARD DISPOSITION CONCURRENCE

FUNCTIONAL SUPERVISION DEP-GRP DATE SAFETY SUPERVISION DATE

-INTERFACE- F.J. ATTAWAYORIGINAL PAGE IS
OF POOR QUALITY

HA-TRACK

01/27/77 PAGE 1

HAZARD ANALYSIS NUMBER	SUBSYSTEM/EQUIPMENT OR OPERATION	LEVEL INIT	HZD TRACK	HAZARD CAT	STATUS	ENTRY DATE
IYXX-0502-02-01	COMM & TRACKING	CA	CN/CN	123	CONTROLLED	030375

HAZARD DESCRIPTION

FRACTURE OF KU-BAND MSBLS WAVEGUIDE SEGMENTS IN RCS BAY

FLIGHT TEST GROUND TEST FERRY FLIGHTS ORBITAL MISSION OTHER
PRELAUNCH LIFT OFF THRU ORBIT ON ORBIT X DE-ORBIT THRU LANDING X

HAZARD GROUP CC FIRE & EXPLOSION

RESP.ENGR. R.F.RAASCH

RELATED FMEAS

NONE

FMEA REQD YES NO

X

REFERENCES

ME413-0038, MC481-0067, MC409-0017, V070-7+2004

HAZARD CAUSES

01-BREAKAGE OF WAVEGUIDE IN RCS BAY CAUSING ARCING

HAZARD EFFECTS

SOURCE OF ARCING IN RCS BAY, POSSIBLE FIRE AND EXPLOSION

ORIGINAL PAGE IS
OF POOR QUALITY

HAZARD NUMBER 1YXX-0502-02-01

RELATED HAZARD ANALYSES

01-1YXX-0302-05

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD -INTERFACE-

SAFETY LEAD W.E.PLAISTED

DISPOSITION

01-REROUTE WAVEGUIDE FROM RCS BAY

RESP GRP ACTION DOCUMENTATION

V070-742004

CLOSURE RATIONALE

THIS HAZARD IS CLOSED AS WAVEGUIDE NO LONGER IS IN RCS BAY PER
V070-742004

HAZARD DISPOSITION CONCURRENCE

FUNCTIONAL SUPERVISION DEP-GRP DATE SAFETY SUPERVISION DATE
-INTERFACE- F.J.ATTAWAY

HAZARD ANALYSIS NUMBER	SUBSYSTEM/EQUIPMENT OR OPERATION	LEVEL INIT	HZD TRACK CAT	HAZARD STATUS	ENTRY DATE
1ZXX-0502-02	COMM & TRACKING	CA	CN/CN 12	CONTROLLED	062074

HAZARD DESCRIPTION

CORONA & ARCING ON ORBITER EQUIPMENT

FLIGHT TEST X GROUND TEST X FERRY FLIGHTS ORBITAL MISSION X OTHER
PRELAUNCH X LIFT OFF THRU ORBIT X ON ORBIT X DE-ORBIT THRU LANDING X

HAZARD GROUP CC FIRE & EXPLOSION

RESP. ENGR R.RAASCH

RELATED FMEAS

FMEA REQD YES NO

NONE.

X

REFERENCES

MSC-00134 REV A ITEM 19; MSC1 8080 DPS#37

HAZARD CAUSES

- 01-LEAKAGE OF SEALED PRESSURIZED COMPONENTS/COMPARTMENTS
02-VACUUM CRITICAL EQUIPMENT VACUUM HOLD CAPABILITY NOT TESTED
03-EQUIPMENT/MATERIALS OUTGASSING
04-SHARP POINTS & EDGES IN HIGH INTENSITY ELECTRIC FIELDS

HAZARD EFFECTS

**CORONA/ARCING IS SOURCE OF IGNITION IN COMBUSTIBLE AIR PARCEL,
COULD LEAD TO LOSS OF VEHICLE & PERSONNEL**

RELATED HAZARD ANALYSES

NONE

HAZARD NUMBER 1ZXX-0502-02

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD CUMMINGS/VARIAN SAFETY LEAD W.E.PLAISTED

DISPOSITION

RESP GRP ACTION DOCUMENTATION

01-THRU 04-DESIGN AVIONICS SYSTEM PER REQUIREMENT 45 OF MIL-STD- 454 AS CALLED OUT IN PARA. 3.4.9. OF MF-0004-002B	392-420 392-430	MF0004-002B
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CLOSURE RATIONALE

HAZARD IS CLOSED AS THE ORBITER RADIATING SYSTEMS HAVE CORONA
AND ARCING CONTROLLING DESIGN CONSTRAINTS, AS CALLED OUT IN
CORRECTIVE ACTION ITEMS ABOVE, INCORPORATED INTO THE SYSTEM DESIGN
REQUIREMENTS PER MF0004-002B

HAZARD DISPOSITION CONCURRENCE

FUNCTIONAL SUPERVISION DEP-GRP	DATE	SAFETY SUPERVISION	DATE
F.CUMMINGS/R.VARIAN	392-4X0 062375	F.J.ATTAWAY	070775

HA-TRALK

02/09/77 PAGE 1

HAZARD ANALYSIS SUBSYSTEM/EQUIPMENT NUMBER	OK OPERATION	LEVEL	HZD INIT TRACK CAT	HAZARD STATUS	ENTRY DATE
1YXX-6562-03	MSBLS WAVEGUIDE	CR	CR/CN 2	IN-WRK	112274

HAZARD DESCRIPTION

LEAKAGE OF MSBLS KU- AND NAVL GUIDE THROUGH PRESSURE BULKHEAD REDUCES CABIN PRESSURE

FLIGHT TEST GROUND TEST FERRY FLIGHTS ORBITAL MISSION X OTHER
PRELAUNCH LIFT OFF THRU ORBIT ON ORBIT X DE-ORBIT THRU LANDING

HAZARD GROUP DD LOSS OF ENVIRONMENT

RESP.ENGR. R.F.RAASCH

RELATED FMLAS

05-2-22001F-2

FMEA REQD YES NO

X

REFERENCES

AVCU DOCUMENT "OTP NO.004 REV "C" PER URL ITEM TMD 3(M)"
HAZARD CAUSES

01-RUPTURE OF WAVEGUIDE WALL AND
02-RUPTURE OF PRESSURE WINDOW
03-LOSS OF PRESSURE SEALS

HAZARD EFFECTS

LEAKAGE THROUGH AN EQUIVALENT .45 IN-DIA CIRCLE (.159 SQ IN)
OR GREATER WILL EXCEED LOSS MAKE UP CAPABILITY. MAX WAVEGUIDE
CROSS SECTION=APPROX.15 SQ IN: LOSS OF MISSION

98

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HAZARD NUMBER 1YXX-0502-02

RELATED HAZARD ANALYSIS

NONE

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD	R.L.DAVIS	SAFETY LEAD	W.E.PLAISTED
DISPOSITION		RESP GRP	ACTION DOCUMENTATION
C1-VIBRATION & PRESSURE CHECK MULTIPLE WAVEGUIDE SEGMENT ASSEMBLIES		392-450	AVCO QTP NO.004, REV C
U2C1-QUALITY FEEDTHROUGH FITTING 6 FITTING-TO-BULKHEAD SEAL USING FEEDTHROUGH FITTING AND RI/SU PROVIDED SEAL		392-450	AVCO QTP NO. 004, REV C

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SD77-SII-0001-06

HA-TRACK

01/27/77 PAGE

HAZARD ANALYSIS NUMBER	SUBSYSTEM/EQUIPMENT OR OPERATION	LEVEL INIT	H2D TRACK	HAZARD CAT	STATUS	ENTRY DATE
1ZXX-0503-02	DISPLAYS-CONTROLS	CR	CN/CN	3	CONTROLLED	091174

HAZARD DESCRIPTION

CREW ALERTED TO NON-EXISTANT FIRE CONDITION BY FALSE ALARM FROM SMOKE DETECTION SUBSYSTEM

**FLIGHT TEST X GROUND TEST FERRY FLIGHTS ORBITAL MISSION X OTHER
PRELAUNCH X LIFT OFF THRU ORBIT X ON ORBIT X DE-ORBIT THRU LANDING X**

HAZARD GROUP CC FIRE & EXPLOSION

RESP. ENGR D.K.MC GRAW

RELATED FMFAS

FMEA READ YES NO

NONE

x

REFERENCES

HAZARD CAUSES

SHORT CIRCUIT IN SMOKE SENSOR

HAZARD EFFECTS

EMERGENCY FIRE ALARM WOULD CAUSE THE CREW TO IMMEDIATELY INVESTIGATE THE CAUSE FOR THE ALARM. PRIOR TO DISCHARGING THE FIRE SUPPRESSANT, THE CREW WOULD TRY AND VERIFY THAT A FIRE CONDITION ACTUALLY EXISTS. EXCESSIVE FALSE ALARMS MAY CAUSE CREW TO LOSE CONFIDENCE IN SYSTEM AND DELAY RESPONSE IN REAL EMERGENCY.

RELATED HAZARD ANALYSES

1ZXX-0602-04-02, 1ZXX-0503-08

HAZARD NUMBER 1ZXX-0503-02

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD B.L.MANN

SAFETY LEAD W.E.PLAISTED

DISPOSITION

PROVIDE SUFFICIENT DESIGN
FEATURES TO ASSIST CREW IN
DISCRIMINATING A FALSE ALARM.
PER MC282-0065 & MC431-0127

RESP GRP ACTION DOCUMENTATION

389-301

CLOSURE RATIONALE

AN ALARM FROM A SINGLE SENSOR IN THE AVIONICS BAYS WOULD NOT BE
SUFFICIENT FOR A CREWMAN TO DISCHARGE THE FIRE SUPPRESSANT. THE
CREW WOULD RESET THE SENSOR AND THEN MAKE A DECISION TO DISABLE
THE SENSOR, INVESTIGATE, OR DISCHARGE THE SUPPRESSANT. IF THE
FIRE ALARM WAS CAUSED BY A FAULTY SENSOR ON THE FLIGHT DECK OR
MID-DECK, THE CREW WOULD REQUIRE SENSORY VERIFICATION BEFORE
DISCHARGING THE PORTABLE EXTINGUISHER. IN ADDITION, IF THE
LIGHT DOES NOT EXTINGUISH FOR AT LEAST 4-SECONDS ON THE RESET
COMMAND, THIS WOULD INDICATE A MALFUNCTION FALSE ALARM.
MC282-0065 & MC431-0127 DETAILS THESE DESIGN PROVISIONS

68

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HAZARD DISPOSITION CONCURRENCE

FUNCTIONAL SUPERVISION DEP-GRP

DATE

SAFETY SUPERVISION

DATE

O.T.STOLL

389-301

F.J.ATTAWAY

071075

HAZARD ANALYSIS NUMBER	SUBSYSTEM/EQUIPMENT UR OPERATION	LEVEL INIT TRACK	R2D CAT	HAZARD STATUS	ENTRY DATE
12XX-0503-03	DISPLAYS-CONTROLS	UR	CN/CN	12	CONTROLLED 091174

HAZARD DESCRIPTION

FAILURE OF CGW SUBSYSTEM TO ALERT CREW OF A MALFUNCTION OR OUT-OF-TOLERANCE CONDITION

PRELAUNCH X LIFT OFF THRU ORBIT X ON ORBIT X DE-ORBIT THRU LANDING X FLIGHT TEST X GROUND TEST FERRY FLIGHTS ORBITAL MISSION X OTHER

HAZARD GROUP DD LOSS OF/UNSAFE ENVIRONMENT RESP. ENGR D.R.MC GRAW

RELATED FMEAS

05-3-12305,-12306,-12309,-12310,-12313

FMEA REQD YES NO

X

REFERENCESHAZARD CAUSES

01-FAILURE OF SENSOR,CGW ELECTRONICS UNIT OR STATUS DISPLAY
02-CGW TUNES NOT ON SPEAKER/MICROPHONE NETWORK

HAZARD EFFECTS

THE CREW WOULD NOT BE ALERTED TO A CONDITION WHICH, IF UNCORRECTED, UR CONTINGENCY PLANS ARE NOT IMPLEMENTED, COULD LEAD TO A LOSS OF CREW, VEHICLE OR MISSION.

RELATED HAZARD ANALYSES

12XX-0503-07, 12XX-0503-08, 12XX-0503-09, 12XX-0503-10

HAZARD NUMBER 12XX-0003-15

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD R.C.LAVEY

SAFETY LEAD W.E.PLAISTED

DISPOSITION

THE HARDWIRED PRIMARY CGW
SUBSYSTEM AND THE SOFTWARE
BACK-UP CGW SATISFY THE
REDUNDANCY REQUIREMENTS OF
MC404-0012

REF GRP ACTION DOCUMENTATION

392-640

CLOSURE RATIONALE

U1- THE CGW SUBSYS IS BASICALLY A REDUNDANT SUBSYSTEM BECAUSE OF THE BACKUP SM SOFTWARE SUBSYSTEM. HOWEVER THERE ARE CASES WHERE BOTH THE PRIMARY AND BACKUP CGW RECEIVE INPUTS FROM A SINGLE TRANSDUCER. THIS WAS NOTED ON KID 1-44 FROM THE DEL SYSTEM REVIEW OF UC1574. THE SINGLE SENSOR CONDITION WAS DISCUSSED AT A SUBSEQUENT TSR AND THE NASA & KI MANAGEMENT DISAPPROVED THE RID RECOMMENDATION ON THE BASIS THAT SINGLE SENSORS ARE ONLY USED IN FDS/FS SYSTEMS AND THAT THERE ARE ADDITIONAL SOURCES OF DATA TO ALERT THE CREW OF HAZARDOUS CONDITIONS.

U2-CGW TONES ARE DISTRIBUTED THROUGHOUT ORBITER BY AUDIO SYSTEM PER RECENT DESIGN CHANGE (MCR 2165)

HAZARD DISPOSITION CONCURRENCE

FUNCTIONAL SUPERVISION DEP-GRP	DATE	SAFETY SUPERVISION DATE
R.GLOD	392-640 302775	F.J.ATTAWAY 071075

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HAZARD ANALYSIS NUMBER	SUBSYSTEM/EQUIPMENT OR OPERATION	LEVEL INIT	HZD TRACK CAT	HAZARD STATUS	ENTRY DATE
1ZXX-0503-04	DISPLAYS-CONTROLS	CR	CN/CN 12	CONTROLLED	090674

HAZARD DESCRIPTION

ACCIDENTAL ACTUATION OF PRIMARY FLIGHT CONTROL "RESET" (OV-101)/
"DIENGAGE" (OV-102) SWITCH WHILE IN BACK-UP FLIGHT CONTROL
WOULD TRANSFER FROM BACK-UP TO PRIMARY MODE AND WOULD CAUSE
SUBSEQUENT LOSS OF FLIGHT CONTROL.

FLIGHT TEST X GROUND TEST FERRY FLIGHTS ORBITAL MISSION X OTHER
PRELAUNCH LIFT OFF THRU ORBIT X UN ORBIT DE-ORBIT THRU LANDING X

HAZARD GROUP FF LOSS OF FLIGHT CONTROL RESP. ENGR D.R.MC GRAW

RELATED FMEAS

FMEA RLQD YES NO

NONE

X

REFERENCESHAZARD CAUSES

THERE IS NO SWITCH GUARD FOR "RESET" (OV-101)/"DIENGAGE" (OV-102) SWITCH OR SOFTWARE LOGIC TO PREVENT ACCIDENTAL TRANSFER BACK INTO PRIMARY FLIGHT MODE DURING MISSION

HAZARD EFFECTS

FLIGHT CONTROL SYSTEM NOT DESIGNED TO SAFELY TRANSFER FROM BACK-UP TO PRIMARY FLIGHT CONTROL MODE.

HAZARD NUMBER 1ZXX-0503-04

RELATED HAZARD ANALYSES

1AXX-0503-05, 1AXX-0503-11

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD	E.MURPHY	SAFETY LEAD	W.E.PLAISTED
DISPOSITION		RESP GRP	ACTION DOCUMENTATION
A SWITCH GUARD IS RECOMMENDED FOR "RESET"(OV-101)/"DISENGAGE"(OV- 102) SWITCH TO PREVENT INADVERTENT ACTUATION		392-640	

CLOSURE RATIONALE

SWITCH GUARDS HAVE BEEN PROVIDED AS REQUIRED, THEREFORE THIS
HAZARD IS CLOSED.

HAZARD DISPOSITION CONCURRENCE

FUNCTIONAL SUPERVISION	DEP-CRP	DATE	SAFETY SUPERVISION	DATE
R.GIBB	392-640	062775	F.J.ATTAWAY	070775

HAZARD ANALYSIS NUMBER	SUBSYSTEM/EQUIPMENT OR OPERATION	LEVEL INIT	HZD TRACK	HAZARD CAT	STATUS	ENTRY DATE
1ZXX-0503-05	DISPLAYS-CONTROLS	CR	LN/CN	12	CONTROLLED	090674

HAZARD DESCRIPTION

EXISTING C&W PARAMETER SELECTION FOR PRIMARY FLIGHT CONTROL FAILURE MAY NOT BE RELIABLE OR SUFFICIENT FOR CREWMAN TO SWITCH TO BACK-UP FLIGHT CONTROL MODE

FLIGHT TEST X GROUND TEST FERRY FLIGHTS ORBITAL MISSION X OTHER
PRELAUNCH LIFT OFF THRU ORBIT X ON ORBIT DE-ORBIT THRU LANDING X

HAZARD GROUP FF LOSS OF FLIGHT CONTROL RESP. ENGR D.R.MC GRAW

RELATED FMEAS

NONE

FMEA REQD YES NO

X

REFERENCES**HAZARD CAUSES**

THIS HA ASSUMES THAT A GENERIC SOFTWARE ERROR EXISTS IN ALL THE PRIMARY FLIGHT CONTROL COMPUTERS AND THAT THIS ERROR WAS NOT DETECTED DURING DEBUGGING TESTS PRIOR TO THE MISSION

HAZARD EFFECTS

INSUFFICIENT &/OR UNRELIABLE COMPUTER FAILURE DISPLAY DATA FOR CREWMAN MAY CONFUSE OR DELAY CREW RESPONSE DURING TIME CRITICAL PERIOD

HAZARD NUMBER 1ZXX-0503-05

RELATED HAZARD ANALYSES

1AXX-0503-04, 1AXX-0503-05, 1ZXX-0503-09, 1XAA-0503-11
1AXX-0507-03

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD M. STRETTON

SAFETY LEAD W.E. PLAISTED

DISPOSITION

PROVIDE ADEQUATE C&W PARAMETERS
AND DEDICATED DISPLAYS TO ALERT
CREW TO FLIGHT CONTROL ANOMALIES

RESP GRP ACTION DOCUMENTATION

382-400

CLOSURE RATIONALE

GPC COMPUTER C&W LIGHT MATRIX EXISTS FOR ALL 5 COMPUTERS. THESE FAILURE SIGNALS WILL BE BASED ON VOTING LOGIC CIRCUITRY AND/OR BITE. THERE ARE SEVERAL OTHER GN&C C&W PARAMETERS WHICH MAY PROVIDE AN INDIRECT INDICATION OF COMPUTER FAILURE. THE DEDICATED FLIGHT INSTRUMENTS SUCH AS ADI, HSI AND AVVI CAN BE USED TO DETERMINE IF THERE ARE FLIGHT CONTROL ANOMALIES. IN ADDITION, PHYSICAL CUES CAN BE USED BY THE CREW TO ASSESS THE FLIGHT CONTROL STATUS, THEREFORE THIS HAZARD IS CLOSED.

HAZARD DISPOSITION CONCURRENCE

FUNCTIONAL SUPERVISION DEP-GRP DATE SAFETY SUPERVISION DATE

G.W.LINDEWALL 382-400 062375 F.J.ATTAWAY 071075

HA-TRACK

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HAZARD ANALYSIS NUMBER	SUBSYSTEM/EQUIPMENT OR OPERATION	LEVEL	HZD CAT	HAZARD STATUS	ENTRY DATE
1ZXX-0503-07	DISPLAYS-CONTROLS	CR	CN/CN 3	CONTROLLED	041174

HAZARD DESCRIPTION

FALSE ALARM FROM C&W SUBSYSTEM INDICATES AN OUT-OF-TOLERANCE OR MALFUNCTION CONDITION

FLIGHT TEST X GROUND TEST FERRY FLIGHTS ORBITAL MISSION X OTHER PRELAUNCH X LIFT OFF THRU ORBIT X ON ORBIT X DE-ORBIT THRU LANDING X

HAZARD GROUP DD LOSS OF/UNSAFE ENVIRONMENT RESP. ENGR D.R.MC GRAW

RELATED FMEAS

NONE

FMEA REQD YES NO

X

REFERENCES

HAZARD CAUSES

OPEN OR SHORT CIRCUIT IN C&W ELECTRONICS OR STATUS DISPLAY AND TRANSIENT IN SYSTEM OR DATA BUS

HAZARD EFFECTS

THE C&W ALARM WOULD PERTURB CREW ACTIVITIES AND WOULD REQUIRE THEM TO ATTEMPT TO VERIFY THE CONDITION. FALSE ALARMS WOULD CAUSE CREW TO LOSE CONFIDENCE IN C&W SUBSYSTEM AND MAY DEGRADE CREW RESPONSE TIME IN REAL EMERGENCY

RELATED HAZARD ANALYSES

1ZXX-0503-02, 1ZXX-0503-08

90-1000-HS-220

96

1ZXX-0503-07

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD D.SMITH

SAFETY LEAD W.E.PLAISTED

DISPOSITION

PROVIDE TRANSIENT PROTECTION
DESIGN FEATURES TO MINIMIZE
LIKELIHOOD OF FALSE ALARMS,
PROVIDE INHIBIT FEATURE TO
SUPPRESS FALSE ALARM AND
PARAMETER LIMIT CHANGE
CAPABILITY PER MC409-UC12

RESP GRP ACTION DOCUMENTATION

392-640

CLOSURE RATIONALE

THE ABOVE CORRECTIVE ACTION ITEMS HAVE BEEN IMPLEMENTED INTO
THE SUBSYSTEM DESIGN

HAZARD DISPOSITION CONCURRENCE

FUNCTIONAL SUPERVISION DEP-GRP

DATE

SAFETY SUPERVISION

DATE

R.GIBB

392-640

F.J.ATTAWAY

071075

HAZARD ANALYSIS NUMBER	SUBSYSTEM/EQUIPMENT OR OPERATION	LEVEL INIT	HZD TRACK CAT	HAZARD STATUS	ENTRY DATE
1ZXX-0503-08	DISPLAYS-CONTROLS	CR	12	DELETED	091174

HAZARD DESCRIPTION

SMOKE DETECTION SUBSYSTEM FAILS TO DETECT INCIPENT FIRE
(THIS HAZARD HAS BEEN DELETED AS IT IS REDUNDANT WITH HAZARDS
1AXX-0602-04 AND 1YXX-0602-04-08)

HA-TRACK

01/27/77 PAGE 1

HAZARD ANALYSIS SUBSYSTEM/EQUIPMENT NUMBER	LEVEL OR OPERATION	INIT	HZD TRACK	HAZARD CAT	STATUS	ENTRY DATE
IZXX-0503-09	DISPLAYS-CONTROLS	CR	CN/CN	12	CONTROLLED	091174

HAZARD DESCRIPTION

PRIMARY C&W EQUIPMENT FAILS TO ALERT CREW OF FAILURE CONDITION
AND BACK-UP C&W DOES NOT IMMEDIATELY ANNUNCIATE CONDITION

FLIGHT TEST X GROUND TEST FERRY FLIGHTS ORBITAL MISSION X OTHER
PRELAUNCH X LIFT OFF THRU ORBIT X ON ORBIT X DE-ORBIT THRU LANDING X

HAZARD GROUP DD LOSS OF/UNSAFE/ENVIRUNMENT RESP. ENGR D.R.MC GRAW

RELATED FMEAS

FMEA REQD YES NO

66

REFERENCES

HAZARD CAUSES

BACK-UP C&W DATA IS FROM PMS. SAMPLING RATE COULD CAUSE A 30 SEC.
DELAY FOR SIGNAL TO C&W PANEL TO ALERT CREW.

HAZARD EFFECTS

A 30 SEC. DELAY IN ALERTING CREW OF ANOMALY COULD AFFECT
CREW CORRECTIVE ACTION. NOTE: BY DEFINITION, ALL C&W
PARAMETERS REQUIRE IMMEDIATE CREW ATTENTION.

RELATED HAZARD ANALYSES

IAXX-0503-11

SD77-SH-0001-06

HAZARD NUMBER 1ZXX-0503-09

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD J.T.KLUTH

SAFETY LEAD W.E.PLASITED

DISPOSITION

RESP GRP ACTION DOCUMENTATION

THE ORIGINAL DELAY CAUSED BY
THE SM FUNCTION WAS DUE TO BOTH
THE SAMPLING RATE AND A TRANSIENT
FILTER VALUE. THE NEW DELAY WILL BE
NO GREATER THAN THREE SECONDS
FOR ANY CGW PARAMETER

382-510

CLOSURE RATIONALE

THE 30-SECOND DELAY HAS BEEN REDUCED TO THREE SECONDS AND IS
DOCUMENTED IN FSSK SD74-SH-02958

HAZARD DISPOSITION CONCURRENCE

FUNCTIONAL SUPERVISION DEP-GRP DATE SAFETY SUPERVISION DATE

A.HARRIS

382-510

F.J.ATTAWAY

022676

HA-TRACK

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HAZARD ANALYSIS NUMBER	SUBSYSTEM/EQUIPMENT OR OPERATION	LEVEL	HZD INIT TRACK CAT	HAZARD STATUS	ENTRY DATE
1ZXX-0503-10	DISPLAYS-CONTROLS	CR	CN/CN 12	CONTROLLED	091174

HAZARD DESCRIPTION

FAILURE TO ALERT CREW OF HAZARDOUS CONDITION ON ORBITER FROM CEW
BECAUSE OF BUS FAILURE

FLIGHT TEST X GROUND TEST FERRY FLIGHTS ORBITAL MISSION X OTHER
PRELAUNCH X LIFT OFF THRU ORBIT X ON ORBIT X DL-ORBIT THRU LANDING X

HAZARD GROUP DD LOSS OF/UNSAFE ENVIRONMENT RESP. ENGR D.R.MC GRAW

RELATED FMEAS

FMEA REQD YES NO

NONE

X

REFERENCES

HAZARD CAUSES

LOSS OF ESSENTIAL POWER BUS SEGMENT

HAZARD EFFECTS

LOSS OF BUS DURING CRITICAL MISSION PHASE RESULTS IN LOSS OF C&W
DATA FOR BOTH PRIMARY AND BACK-UP C&W. HAZARD MAY DEVELOP WHICH
REQUIRES IMMEDIATE CREW ALERT AND CORRECTIVE ACTION.

RELATED HAZARD ANALYSES

1ZXX-0506-10, 1ZXX-0503-03

101

S 277 - SH - 0001 - 06

HAZARD NUMBER 1ZXX-0503-10

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD D.SMITH

SAFETY LEAD W.E.PLAISTED

DISPOSITION

RESP GRP ACTION DOCUMENTATION

PROVIDE POWER REDUNDANCY IN C&W
ELECTRONICS AND C&W FAILURE
ANNUNCIATION WITH AUXILIARY
POWER SUPPLY PER MC409-0012

392-640

CLOSURE RATIONALE

TWO POWER SUPPLIES ARE ACTIVE IN THE C&W ELECTRONICS
THEREBY ASSURING ANNUNCIATION. IN ADDITION, THE C&W IS REDUNDANT
BECAUSE OF THE PARALLEL HARDWIRE AND SOFTWARE BACK-UP INPUTS.
REF: MC409-0012. CLOSURE OF THIS HAZARD IS ALSO JUSTIFIED ON THE
BASIS OF THE REQUIREMENTS IN THE CERTIFICATION PLAN:SD74-SH-0045.

HAZARD DISPOSITION CONCURRENCE

FUNCTIONAL SUPERVISION DEP-GRP	DATE	SAFETY SUPERVISION	DATE
R.GIBB	392-640	F.J.ATTAWAY	071075

HAZARD ANALYSIS SUBSYSTEM/EQUIPMENT NUMBER	LEVEL OR OPERATION	INIT	H2D TRACK	HAZARD CAT	STATUS	ENTRY DATE
1ZXX-0503-11	DISPLAYS-CONTROLS	CR	CN/CN	12	CONTROLLED	091174

HAZARD DESCRIPTION

C&W SUBSYSTEM INDICATES LOSS OF PRIMARY FLIGHT CONTROL SYSTEM DUE TO FAILURE OF ALL PRIMARY FLIGHT CONTROL COMPUTERS. INSUFFICIENT TIME FOR CREW TO SWITCH TO BACK-UP FLIGHT CONTROL MODE.

FLIGHT TEST X GROUND TEST	FERRY FLIGHTS	ORBITAL MISSION X OTHER
PRELUNCH LIFT OFF THRU ORBIT X ON ORBIT	DE-ORBIT THRU LANDING X	

HAZARD GROUP FF LOSS OF FLIGHT CONTROL	RESP. ENGR D.R.MC GRAW
--	------------------------

RELATED FMEAS

FMEA REQD YES NO

05-8-BFCS01 THRU 05-8-BFCS16

X

REFERENCES**HAZARD CAUSES**

THIS HA ASSUMES THAT A GENERIC SOFTWARE ERROR EXISTS IN ALL THE PRIMARY FLIGHT CONTROL COMPUTERS AND THAT THIS ERROR WAS NOT DETECTED DURING DEBUGGING TESTS PRIOR TO THE MISSION.

HAZARD EFFECTS

A CREWMAN HAS A RANGE OF RESPONSE TIMES TO MANUALLY SWITCH FROM PRIMARY TO BACK-UP CONTROL MODE FROM 2.1 SECONDS AT 8000 FT. OR HIGHER, TO .4 SECONDS AT APPROXIMATELY 200 FT. FAILURE TO MANUALLY SWITCH MODES WITHIN THESE TIME CONSTRAINTS MAY RESULT IN LOSS OF THE VEHICLE

HAZARD NUMBER 1ZXX-0503-11

RELATED HAZARD ANALYSES

1AXX-0503-05, 1ZXX-0503-04

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD M.STRETTON

SAFETY LEAD W.E.PLAISTED

DISPOSITION

RESP GRP ACTION DOCUMENTATION

PROVIDE ADEQUATE DISPLAYS TO
INDICATE FAILURE IN PRIMARY
FLIGHT CONTROL SYSTEM. PROVIDE
EASILY ACCESSIBLE LOCATION FOR
BACKUP FLIGHT CONTROL ENGAGE
SWITCH. PERFORM MAN IN LOOP
SIMULATION TESTS TO ASSESS
CREW RESPONSE TIMES.

382-400

CLOSURE RATIONALE

HAZARD IS CLOSED BASED ON COMPLIANCE WITH ABOVE CORRECTIVE
ACTION. SIMULATION TESTS DEMONSTRATED ADEQUACY OF EXISTING
DESIGN FOR INITIATION OF BACK-UP FLIGHT CONTROL SYSTEM.

HA-TRACK

01/27/77 PAGE 1

HAZARD ANALYSIS SUBSYSTEM/EQUIPMENT NUMBER	LEVEL OR OPERATION	INIT	HZD TRACK	HAZARD CAT	STATUS	ENTRY DATE
1ZXX-0503-12	DISPLAYS-CONTROLS	CR	CN/CN	12	CONTROLLED	092674

HAZARD DESCRIPTION

LOSS OF FLIGHT CONTROL STABILITY AND CREWMAN ELECTS TO DOWNMODE
IN PRIMARY RATHER THAN TRANSFER TO BACK-UP FLIGHT CONTROL SYSTEM

FLIGHT TESTX	GROUND TEST	FERRY FLIGHTS	ORBITAL MISSION X	OTHER
PRELAUNCH	LIFT OFF THRU URBIT X	ON ORBIT	DE-ORBIT THRU	LANDING X

HAZARD GROUP FF LOSS OF FLIGHT CONTROL	RESP. ENGR D.R.MC GRAW
--	------------------------

RELATED FMEAS

NONE

FMEA REQU YES NO

X

REFERENCESHAZARD CAUSES

SOFTWARE ERROR IN COMPUTER PROGRAM AFFECTING ALL FOUR PFCS GNEC
COMPUTERS

HAZARD EFFECTS

VALUABLE TIME IS SPENT IN DOWNMODING BUT ALL PFCS MODES ARE
INOPERATIVE AND BY THE TIME CREWMAN ENGAGES BACK-UP SYSTEM,
FLIGHT CONTROL HAS DEGRADED TO THE POINT OF NOT BEING
RECOVERABLE

105

SD72-SII-0001-06

HAZARD NUMBER 1ZXX-0503-12

RELATED HAZARD ANALYSES

1AXX-0503-04, 1AXX-0503-05, 1AXX-0503-11, 1AXX-0505-01,
1AXX-0507-03

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD M. STRETTON

SAFETY LEAD W.E.PLAISTED

DISPOSITION

RESP GRP ACTION DOCUMENTATION

SIMULATION TESTS ARE PLANNED TO
ESTABLISH CRITERIA FOR BACK-UP
FLIGHT CONTROL ENGAGEMENT
DECISION-MAKING. SIMULATION STUDY
WILL ADDRESS INITIATION
DECISIONS, DOWNMODING AND SYSTEM
RESPONSE TIMES AND VEHICLE
RECOVERABILITY CONSTRAINTS.
THESE PLANS ARE DOCUMENTED IN
SD74-SH-0246 AND SD74-SH-0137

382-400

CLOSURE RATIONALE

SIMULATION TESTS INDICATED THAT CREW JUDGEMENT MUST BE EXERCISED
IN DECIDING WHETHER TO DOWNMODE IN PFCS OR TO IMMEDIATELY EN-
GAGE BFCS. AT HIGH ALTITUDE AND WITH MINOR STABILITY PROBLEMS,
IT MAY BE POSSIBLE TO DOWNMODE BUT THIS MAY NOT BE TRUE AT LOWER
ALTITUDES OR WITH MAJOR FLIGHT STABILITY PROBLEMS. THE TEST
RESULTS HAVE BEEN TRANSMITTED TO JSC FOR CREW FLIGHT TRAINING;
THEREFORE THIS HAZARD IS CLOSED.

HA-TRAK

02/09/77 PAGE 1

HAZARD ANALYSIS SUBSYSTEM/EQUIPMENT NUMBER	LK LVLKATLN	LEVEL INIT TRACK CAT	HAZARD STATUS	ENTRY DATE
12XX-USU3-13	DISPLAYS-CONTROLS	LK CN/CN 12	CONTROLLED	092674

HAZARD DESCRIPTION

MECHANICAL FAILURE IN ROTATION HAND CONTROLLER RESULTS IN LOSS OF FLIGHT CONTROL

FLIGHT TEST X GROUND TEST FERRY FLIGHTS ORBITAL MISSION X OTHER
PRELAUNCH LIFT OFF INTO ORBIT X ON ORBIT DE-ORBIT THRU LANDING X

HAZARD GROUP FF LOSS OF FLIGHT CONTROL RESP. ENGR D.R.M. GRAW

RELATED FMEAS

FMEA REQD YES NO

05-1-FC3042-1

X

REFERENCES

HAZARD CAUSES

01-PHYSICAL JAMMING OF HAND CONTROLLER
02-MECHANICAL LINKAGE FAILURE OF HAND CONTROLLER

HAZARD EFFECTS

WORST CASE SITUATION IS FAILURE IN HARDBOVER POSITION AND HIGH KILL RATES RESULTING IN LOSS OF FLIGHT CONTROL.

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OF POOR QUALITY

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SD77-SH-0001-06

HA-TRAK

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HAZARD NUMBER 1ZXX-0503-13

RELATED HAZARD ANALYSIS

1YXX-0503-17

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD K.F.WULF

SAFETY LEAD W.E.PLAISTED

DISPOSITION

RESP GRP ACTION DOCUMENTATION

PROVIDE SAFETY FEATURES SO THAT
CREW CAN DISABLE FAILED HAND
CONTROLLER AND SWITCH TO
REDUNDANT CONTROLLER

392-210

CLOSURE RATIONALE

A HAND CONTROLLER DISABLE SWITCH HAS BEEN PROVIDED FOR EACH
CONTROLLER ON THE FLIGHT PANEL. THE TUGGLE SWITCH IS WITHIN
EASY REACH OF EACH CREWMAN SO THAT IF ONE CONTROLLER JAMMED, ONE
CREWMAN CAN DISABLE IT AND THE OTHER CREWMAN CAN TAKE OVER
CONTROL WITH THE REDUNDANT STICK. REF:VL70-730101

HAZARD DISPOSITION CONCURRENCE

FUNCTIONAL SUPERVISION DEP-GRP DATE SAFETY SUPERVISION DATE

K.L.ANTLETZ

392-210

F.J.ATTAWAY

071075

MA-TRACK

02/09/77 PAGE 1

HAZARD ANALYSIS SUBSYSTEM/EQUIPMENT NUMBER	UR OPERATION	LEVEL INIT TRACK CAT	HAZARD STATUS	ENTRY DATE
2YXX-C5LJ-14	DISPLAYS-CONTROLS	UR CN/CN 3	CONTROLLED	110474

HAZARD DESCRIPTION

ERRONEOUS OUTPUT FROM RAPID DELTA P EQUIPMENT ACTIVATES EMERGENCY ALARM

FLIGHT TEST ORBITAL TEST FERRY FLIGHTS ORBITAL MISSION X OTHER
PRELAUNCH LIFT OFF THRU ORBIT X ON ORBIT X DE-ORBIT THRU LANDING X

HAZARD GROUP DD LOSS OF/UNSAFE ENVIRONMENT RESP.ENGR. D.R. MCGRAN

109

RELATED FMLAS

FMEA REQD	YES	NO
	X	

CS-3-12345,-12360,-12364,-12310,-12313

REFERENCES

NONE

SD 77-SH-0001-06

ORIGINAL PAGE IS
OF POOR QUALITY

HAZARD CAUSES

SHRT CIRCUIT IN SENSER, ELECTRNLIS PACKAGE UR DISPLAY UNIT

HAZARD EFFECTS

THE EMERGENCY ALARM WOULD PERFORM UNW ACTIVITIES AND REQUIRE THEM TO IMMEDIATELY INVESTIGATE THE CAUSE OF THE ALARM. UNDER WORST CASE CONDITIONS, THE CREW MAY INITIATE PRELIMINARY ABORT PROCEDURES. FALSE EMERGENCY ALARM(S) MIGHT CAUSE CREW TO LOSE CONFIDENCE IN WARNING SYSTEM AND RESULT IN DELAY IN EMERGENCY

HAZARD NUMBER 1YXX-USC13-14

RELATED HAZARD ANALYSES

1YXX-USC13-15

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD J.M. WADA

SAFETY LEAD W.E. PLAISTED

DISPOSITION

RESP GRP ACTION DOCUMENTATION

PROVIDE DEDICATED CABIN PRESSURE
METER TO VERIFY CONDITION.
PROVIDE OTHER CLW PARAMETERS
WHICH CAN BE USED TO VERIFY THE
CONDITION, I.E., TOTAL CABIN
PRESSURE, PPOZ AND FLOW RATES.

389-501

CLOSURE RATIONALE

THE ABOVE DEDICATED METERS AND CLW PARAMETERS HAVE BEEN IMPLI-
MENTED IN THE VEHICLE DESIGN. THESE BACKUP OR SECONDARY
SOURCES OF DATA SHOULD PRECLUDE ANY DETERIMENTAL EFFECTS FROM
THIS HAZARD. THEREFORE, THIS HAZARD IS CLOSED.

HAZARD ANALYSIS SUBSYSTEM/EQUIPMENT NUMBER	OK OPERATION	LEVEL	HAZARD CAT	HAZARD STATUS	ENTRY DATE
1YXX-L063-15	DISPLAYS-CONTROLS	CR	UN/LN ULZ	UNCONTROLLED	110474

HAZARD DESCRIPTION

EXTERNAL LEAKAGE FROM CREW CABIN AND RAPID DELTA PRESSURE
DETECTION EQUIPMENT FAILS TO ALERT CREW BY EMERGENCY ALARM

FLIGHT TEST GROUND TEST FERRY FLIGHTS ORBITAL MISSION X OTHER
PRELAUNCH LIFT OFF THRU ORBIT X UN ORBIT X DE-ORBIT THRU LANDING X

HAZARD GROUP DU LOSS OF UNSAFE ENVIRONMENT RFSP. ENGR D.K.MC GRAW

RELATED FMEAS

FMEA REQD YES NO

05-3-12305,-12306,-12309,-12310,-12313

X

REFERENCES

NONE

SD 77-SH-0001-06

HAZARD CAUSES

OPEN LR SHRT CIRCUIT IN SENSOR, ELECTRONICS PACKAGE OR DISPLAY
UNIT. NOTE: THERE IS ONLY A SINGLE RAPID DELTA P MEASUREMENT FOR
THE CAUTION AND WARNING SYSTEM

HAZARD EFFECTS

AN UNDETECTED AND/LR UNCORRECTED LOSS OF CABIN AIR COULD RESULT
IN UNNECESSARY LOSS OF CONSUMABLES WHICH MIGHT ENDANGER CREW

ORIGINAL PAGE IS
OF POOR QUALITY

HA-1RACK

02/04/77 PAGE

HAZARD NUMBER 1YXX-0503-15

RELATED HAZARD ANALYSES

1YXX-0503-14

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD J.M.KAUA

SAFETY LEAD W.E.PLAISTED

DISPOSITION

A REDUNDANT RAPID DELTA PRESSURE
TRANSDUCER IS RECOMMENDED AS AN
"OR" INPUT TO EXISTING CGW LIGHT

RESP GRP ACTION DOCUMENTATION

385-301

CLOSURE RATIONALE

A REDUNDANT DELTA PRESSURE TRANSDUCER IS NOT REQUIRED AS THERE
ARE OTHER CGW PARAMETERS WHICH WOULD ALERT CREW OF EXTERNAL
LEAKAGE. THESE ARE TOTAL CABIN PRESSURE, PPOZ AND O2/N2 FLOW
RATES. THERE ARE ALSO DEDICATED MFTERS FOR ALL THESE PARAMETERS
ON THE MAIN FLIGHT PANEL.

ORIGINAL PAGE IS 112
OF 1100 QUALITY

SD77-SH-0001-06

HA-TRACK

01/27/77 PAGE

HAZARD ANALYSIS NUMBER	SUBSYSTEM/EQUIPMENT OR OPERATION	LEVEL INIT	HD TRACK	HAZARD CAT	STATUS	ENTRY DATE
1YXX-0503-16	DISPLAYS-LCNTROLS	CR	CN/CN	012	CONTROLLED	110674

HAZARD DESCRIPTION

GROUND STATION DETECTS IMPENDING OR ACTUAL HAZARDOUS CONDITION FOR ORBITER BUT ORBITER CREW IS IN SLEEP MODE

**FLIGHT TEST GROUND TEST FERRY FLIGHTS ORBITAL MISSION X OTHER
PRELAUNCH LIFT OFF THRU ORBIT ON ORBIT X DE-ORBIT THRU LANDING**

HAZARD GROUP DD UNSAFE ENVIRONMENT

RESP. ENGR D.K.MC GRAH

RELATED FMEAS

EMEA REQD YES NO

NONE

x

REFERENCES

NONE

HAZARD CAUSES

NO PROVISION AVAILABLE FOR GROUND STATION TO SEND UPLINK COMMAND
FOR CEW ALARM TO ALERT CREW

HAZARD EFFECTS

CREW IN SLEEP MODE WOULD NOT BE ALERTED TO HAZARDOUS CONDITIONS

RELATED HAZARD ANALYSES

NONE

HAZARD NUMBER 1YXX-0503-16

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD R.C.LAVEY

SAFETY LEAD W.E.PLAISTED

DISPOSITION

RESP GRP ACTION DOCUMENTATION

PROVIDE CAPABILITY FOR GROUND
COMMAND TO ACTIVATE C&W LIGHT AND
AURAL ALARM

342-310

CLOSURE RATIONALE

THE SPEAKER BOXES CAN BE USED TO ANNOUNCE A VOICE COMMAND
FROM THE GROUND TO AWAKEN THE CREW AND APPRISE THEM OF ANY
HAZARDOUS CONDITIONS. IN ADDITION, THE ON-BOARD WARNING
ALARMS, IE, EMERGENCY, C&W, AND SM CREW ALERT, SHOULD BE ADEQUATE
TO ALERT THE CREW OF HAZARDS.

HAZARD ANALYSIS SUBSYSTEM/EQUIPMENT NUMBER	UR OPERATION	LEVEL INIT	HZD TRACK CAT	HAZARD STATUS	ENTRY DATE
1YXX-0503-17	DISPLAYS-CONTROLS	UR	UN/CN	UIZ	CONTROLLED 110674

HAZARD DESCRIPTION

IMPACT OF ORBITER WITH PAYLOAD BECAUSE OF FAILED TRANSLATION OR ROTATION HAND CONTROLLER

FLIGHT TEST ORBITAL TEST FERRY FLIGHTS ORBITAL MISSION X OTHER
PRELAUNCH LIFT OFF THRU ORBIT ON ORBIT X DE-ORBIT THRU LANDING

HAZARD GROUP BB COLLISION/IMPACT

RESP. ENGR D.R.MC GRAN

RELATED FMEAS

FMEA REQD YES NO

05-1-FC3042-1

X

REFERENCES

NONE

HAZARD CAUSES

01-PHYSICAL JAMMING OF HAND CONTROLLER
02-MECHANICAL LINKAGE FAILURE OF HAND CONTROLLER

HAZARD EFFECTS

A FAILED HAND CONTROLLER IN A PAYLOAD RETRIEVAL MODE COULD CAUSE CONTINUOUS THRUST FROM A THRUSTER AND SUBSEQUENT IMPACT DAMAGE TO THE ORBITER AND/OR PAYLOAD

HA-TRACK

02/04/77 PAGE 2

HAZARD NUMBER 1XX-0503-17

RELATED HAZARD ANALYSIS

1XX-0503-1a

HAZARD IDENTIFICATION CONCERN

FUNCTIONAL LEAD R.F. WULFE

SAFETY LEAD W.E. PLAISTED

DISPOSITION

RESP GRP ALTION DOCUMENTATION

RECOMMEND PROVISION IN SOFTWARE
LOGIC TO PERMIT OVERRIDE OF
JAMMED HAND CONTROLLER OR TOGGLE
SWITCH TO DISABLE UNIT

CLOSURE RATIONALE

POWER CONTROL SWITCHES HAVE BEEN PROVIDED TO THE FORWARD AND AFT
FLIGHT STATIONS. THESE TOGGLE SWITCHES CAN BE USED TO DISABLE
A HAND CONTROLLER

OF THE ORIGINAL PAGE IS

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HA-TRACK

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HAZARD ANALYSIS NUMBER	SUBSYSTEM/EQUIPMENT OR OPERATION	LEVEL INIT	HZD TRACK	HAZARD CAT	STATUS	ENTRY DATE
1YXX-0503-18	DISPLAYS-CONTROLS	CR	CN/CN	12	UNCONTROLLED	022875

HAZARD DESCRIPTION

FAILURE OF PRESSURE TRANSDUCER IN AN UMS ENGINE PRESSURE CHAMBER
MAY RESULT IN FAILURE TO ENERGIZE THE C&W LIGHT AND ALERT THE
CREW OF AN OMS ENGINE OUT SITUATION WHICH IS AN ABORT CONDITION.

FLIGHT TEST GROUND TEST FERRY FLIGHTS ORBITAL MISSION X OTHER
PRELAUNCH LIFT OFF THRU ORBIT X ON ORBIT DE-ORBIT THRU LANDING

HAZARD GROUP FF LOSS OF FLIGHT CONTROL RESP.ENGR. D.R. MCGRAW

RELATED FMEAS

FMEA RECD YES NO

NONE

REFERENCES

NONE

HAZARD CAUSES

THERE IS ONLY A SINGLE PRESSURE TRANSDUCER IN EACH UMS PRESSURE CHAMBER. THERE ARE NO SPECIFIC UMS ENGINE OUT LIGHTS. IN ADDITION THERE IS NO DIRECT UMS ENGINE OUT PARAMETER ON THE CEW.

HAZARD EFFECTS

CREW RESPONSE MAY BE DELAYED TO AN ABURT CONDITION. CREW RESPONSE
MAY BE TIME-CRITICAL AT MUDE BOUNDARY PHASE OF MISSION.

HAZARD NUMBER 1YXX-0503-18

RELATED HAZARD ANALYSES

1YXX-0503-19

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD D.R. HAFNER

SAFETY LEAD W.E. PLAISTED

DISPOSITION

PROVIDE REDUNDANT OMS CHAMBER
PRESSURE SENSORS OR PROVIDE ADDI-
TIONAL DATA INPUT SUCH AS AN
ACCELEROMETER READING TO
SOFTWARE PROGRAM TO ASSESS OMS
ENGINE FAILURE

RESP GRP ACTION DOCUMENTATION

390-700

CLOSURE RATIONALE

REDUNDANT ACCELERATION INPUTS ARE USED BY SOFTWARE TO DETECT
OMS ENGINE OUT CONDITION. THEREFORE THIS HAZARD IS CLOSED.

HA-TRACK

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HAZARD ANALYSIS SUBSYSTEM/EQUIPMENT NUMBER	LEVEL OR OPERATION	INIT	M2D TRACK CAT	HAZARD STATUS	ENTRY DATE
1YXX-0503-19	DISPLAYS-CONTROLS	CR	CN/CN 12	CONTROLLED	022875

HAZARD DESCRIPTION

IF AN ABORT LITE COMES "ON", THERE MAY NOT BE SUFFICIENT TIME TO DETECT THE SPECIFIC CAUSE THAT TRIGGERED THE ALARM AND TO VERIFY THE CONDITION

FLIGHT TEST GROUND TEST FERRY FLIGHTS ORBITAL MISSION X OTHER
PRELAUNCH LIFT OFF THRU ORBIT X ON ORBIT DE-ORBIT THRU LANDING

HAZARD GROUP FF LOSS OF FLIGHT CONTROL RESP.ENGR. D.R. MCGRAW

RELATED FMEAS

FMEA REQD YES NO

NONE

X

REFERENCES

NONE

HAZARD CAUSES

THERE ARE NO PROVISIONS TO QUICKLY DISPLAY TO THE CREW ALL THE INFORMATION NECESSARY TO IDENTIFY AND VERIFY THE ABORT CONDITION. ALL OF THE ABORT PARAMETERS ARE NOT DISPLAYED ON C&W PANEL.

HAZARD EFFECTS

A DELAY IN IDENTIFYING AND VERIFYING AN ABORT CONDITION COULD AFFECT CREW RESPONSE IN TIME-CRITICAL ABORT SITUATIONS.

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HAZARD NUMBER 1YXX-0503-19

RELATED HAZARD ANALYSES

1YXX-0503-18, 1YXX-0503-20

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD D.R. HAFNER

SAFETY LEAD W.E. PLAISTED

DISPOSITION

PROVIDE SUFFICIENT DISPLAYS ON
FLIGHT PANEL SO THAT CREW CAN
QUICKLY VERIFY ABORT CONDITION

RESP GRP ACTION DOCUMENTATION

390-700

NOTE: MCR 2030 HAS BEEN RELEASED
AND THERE IS A REQUIREMENT TO PRO-
VIDE ADEQUATE DEDICATED AND SHARED
METERS, AND CRT DISPLAYS TO
ALLOW CREW ABORT VERIFICATION

CLOSURE RATIONALE

THE ABORT LITE IS ONLY AN ADVISORY DISPLAY WHICH IS TRIGGERED
BY AN UPLINK GROUND COMMAND. THE CREW WILL NOT INITIATE AN ABORT
UNLESS THERE IS ON-BOARD VERIFICATION. THERE ARE BOTH MPS &
OMS ENGINE OUT WARNING LITES ON THE MAIN PANEL. THERE ARE ALSO
DEDICATED METERS FOR THESE ABORT PARAMETERS. HAZARD IS CLOSED.

HAZARD ANALYSIS SUBSYSTEM/EQUIPMENT NUMBER	LEVEL OF OPERATION	INIT TRACK	H2D CAT	HAZARD STATUS	ENTRY DATE
1YXX-0503-20	DISPLAYS-CONTROLS	CR	CN/CN 12	CONTROLLED	022875

HAZARD DESCRIPTION

IN AN ABORT SITUATION, THE "G" FORCES MAY BE TOO HIGH TO EFFECTIVELY USE THE CONTROLS AND DISPLAYS TO VERIFY AND INITIATE AN ABORT

FLIGHT TEST GROUND TEST FERRY FLIGHTS ORBITAL MISSION X OTHER
PRELAUNCH LIFT OFF THRU ORBIT X ON ORBIT DE-ORBIT THRU LANDING

HAZARD GROUP FF LOSS OF FLIGHT CONTROL RESP.ENGR. D.R.MCGRAW

RELATED FMEAS

FMEA REQD YES NO

NONE

X

REFERENCES

NONE

HAZARD CAUSES

IN AN ABORT SITUATION, SEVERAL SEQUENTIAL STEPS MAY BE NECESSARY TO CHECK-OUT THE CONDITION. ROTARY SWITCHES, CRT KEYBOARD AND PUSHBUTTON SWITCHES MAY HAVE TO BE OPERATED BY THE CREW.

HAZARD EFFECTS

AN UNNECESSARY DELAY MAY BE CREATED IN CREW RESPONSE TO A POSSIBLY TIME-CRITICAL ABORT SITUATION.

HAZARD NUMBER 1YXX-0503-20

RELATED HAZARD ANALYSES

1YXX-0503-19

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD D.R. HAFNER

SAFETY LEAD W.E. PLAISTED

DISPOSITION

RESP GRP ACTION DOCUMENTATION

CREW SIMULATIONS HAVE INDICATED
THAT REACH IS ACCEPTABLE UNDER
3 "G" CONDITIONS; HOWEVER THIS
ITEM WILL REMAIN OPEN UNTIL
ALL THE ABORT RELATED CONTROLS
AND DISPLAYS HAVE BEEN FIRMLY
BASELINED

CLOSURE RATIONALE

ABORT CONTROLS AND DISPLAYS HAVE BEEN BASELINED AND THEY ARE
ALL ACCESSIBLE TO THE CREW UNDER 3 "G" CONDITIONS. HAZARD IS
CLOSED.

HAZARD ANALYSIS SUBSYSTEM/EQUIPMENT NUMBER	LEVEL OR OPERATION	INIT	HZD TRACK CAT	HAZARD STATUS	ENTRY DATE
1YXX-0503-21	DISPLAYS-CONTROLS	CR	CN/CN 12	CONTROLLED	022875

HAZARD DESCRIPTION

ERRONEOUS ABORT SIGNAL ENERGIZES ABORT LIGHT RESULTING IN UNNECESSARY ABORT AND INCREASED RISK OF ACCIDENT

FLIGHT TEST GROUND TEST FERRY FLIGHTS ORBITAL MISSION X OTHER
PRELAUNCH LIFT OFF THRU ORBIT X ON ORBIT DE-ORBIT THRU LANDING

HAZARD GROUP FF LOSS OF FLIGHT CONTROL RESP.ENGR. D.R. MCGRAW

RELATED FMEAS

FMEA REQD YES NO

NONE

X

REFERENCES

NONE

HAZARD CAUSES

1. SINGLE TRANSDUCER FAILURE FOR ABORT PARAMETER OUTPUTS
ERRONEOUS SIGNAL
2. SHORT CIRCUIT IN CONDITIONING CIRCUIT OR LIGHT

HAZARD EFFECTS

THE REQUIRED TIME FOR A CREW RESPONSE TO AN ABORT LIGHT IS A FUNCTION OF MISSION PHASE. AT CRITICAL MODE BOUNDARIES, RAPID CREW ACTION TO INITIATE ABORT MODE IS ANTICIPATED. SELECTIVE DUMPING OF ORBITER/PAYLOAD PROPELLANTS AND PRESSURANTS MAY BE IMPLEMENTED; HOWEVER ABORT ACCIDENT POTENTIAL STILL EXISTS.

HAZARD NUMBER 1YXX-0503-21

RELATED HAZARD ANALYSES

1YXX-0503-19

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD D.R. HAFNER

SAFETY LEAD W.E. PLAISTED

DISPOSITION

RESP GRP ACTION DOCUMENTATION

PROVIDE SUFFICIENT FLIGHT DISPLAYS FOR CREW TO MAKE ON-BOARD ABORT DECISION WITH POSSIBLE ASSISTANCE FROM GROUND STATIONS

390-700

NOTE: MCR 2030 INDICATES THAT AN ABORT WILL BE CREW INITIATED, MODE SELECTED AND VERIFIED AND THAT ADEQUATE DISPLAYS WILL BE PROVIDED FOR CREW TO PERFORM THESE FUNCTIONS

CLOSURE RATIONALE

THE ABORT LIGHT IS ONLY AN ADVISORY LIGHT FROM THE GROUND. IT WILL NOT CAUSE AN ABORT INITIATION UNLESS THE CREW VERIFIES THE CONDITION AND MANUALLY INITIATES THE ABORT ACTION. THE NECESSARY ABORT DISPLAYS AND CONTROLS ARE EASILY ACCESSIBLE TO THE CREW.

HA-TRACK

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HAZARD ANALYSIS NUMBER	SUBSYSTEM/EQUIPMENT OR OPERATION	LEVEL	HZD INIT TRACK CAT	HAZARD STATUS	ENTRY DATE
1YXX-05C3-22	DISPLAYS-CONTROLS	CR	CN/CN 12	CONTROLLED	022675

HAZARD DESCRIPTION

AN OMS ENGINE OUT CONDITION WILL TRIGGER AN ABORT LITE AND ALARM
BUT THE SOLUTION TO THE PROBLEM MAY CONSIST OF AN EXTENDED OMS
BURN RATHER THAN AN IMMEDIATE ABORT

FLIGHT TEST GROUND TEST FERRY FLIGHTS ORBITAL MISSION X OTHER
PRELAUNCH LIFT OFF THRU ORBIT X ON ORBIT DE-ORBIT THRU LANDING

HAZARD GROUP FF LOSS OF FLIGHT CONTROL RESP.ENGR. D.R. MCGRAW

RELATED FMEAS FMEA REQD YES NO

NONE X

REFERENCES

NONE

HAZARD CAUSES

AN OMS ENGINE OUT CONDITION IS ONE OF TWO CONDITIONS WHICH CAN
RESULT IN AN INTACT ABORT. THEREFORE THE ABORT LITE AND AUDIBLE
ALARM WILL ENERGIZE WITH A LOW THRUST CONDITION FROM AN OMS
ENGINE, HOWEVER SUBSEQUENTLY THE ASLRT PROGRAM MAY INDICATE THAT
AN IMMEDIATE ABORT IS NOT NECESSARY.

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HAZARD NUMBER 1YXX-0503-22

HAZARD EFFECTS

AN ABORT ALARM SHOULD BE A POSITIVE INDICATION THAT AN ABORT IS REQUIRED. A FALSE ALARM OR A DECISION THAT IS LATER REVERSED, MAY CAUSE THE CREW TO LOSE CONFIDENCE IN THE ALARM WHICH MAY LATER AFFECT CREW RESPONSE TIMES TO THE WARNING.

RELATED HAZARD ANALYSES

1YXX-0503-19

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD D.R. HAFNER

SAFETY LEAD W.E. PLAISTED

DISPOSITION

RESP GRP ACTION DOCUMENTATION

PROVIDE SUFFICIENT C&W AND OTHER FLIGHT DISPLAY INFORMATION SO THAT CREW, WITH POSSIBLE BACK-UP GROUND STATION SUPPORT, CAN MAKE ABORT DECISION

390-700

NOTE: MCR 2030 INDICATES THAT THERE WILL NOT BE A COMPUTER GENERATED ABORT SIGNAL. ABORTS WILL BE SELECTED, INITIATED AND VERIFIED BY THE CREW AND NOT THE COMPUTER

CLOSURE RATIONALE

THE ABOVE CORRECTIVE ACTION HAS BEEN IMPLEMENTED IN THE DESIGN. THE ABORT LIGHT IS ONLY AN ADVISORY DISPLAY. THERE ARE ADEQUATE C&W ALARMS AND DEDICATED METERS FOR THE CREW TO DETECT AND INITIATE AN ABORT

HAZARD ANALYSIS NUMBER	SUBSYSTEM/EQUIPMENT OR OPERATION	LEVEL INIT	HZD TRACK CAT	HAZARD STATUS	ENTRY DATE
1YXX-0503-23	DISPLAYS-CGNTROLS	CR	CN/CN 12	CONTROLLED	022875

HAZARD DESCRIPTION

A HAZARDOUS LEVEL OF CARBON DIOXIDE DEVELOPS IN THE CABIN DUE TO FAILURE OF CO₂ SCRUBBER EQUIPMENT AND CREW IS NOT ALERTED TO CONDITION BY AVIONICS EQUIPMENT

FLIGHT TEST GROUND TEST FERRY FLIGHTS OREITAL MISSION X OTHER
PRLAUNCH LIFT OFF THRU ORBIT X ON ORBIT X DE-ORBIT THRU LANDING X

HAZARD GROUP DD UNSAFE ENVIRONMENT

RESP.ENGR. D.R. MCGRAW

RELATED FMEAS

FMEA REQD YES NO

06-1-0341

X

REFERENCES

NONE

HAZARD CAUSES

THE REDUNDANT CO₂ SCRUBBERS BECOME CONTAMINATED AND INEFFECTIVE. A FAILURE OF THE SINGLE CO₂ SENSOR WOULD RESULT IN FAILURE TO ALERT CREW. IN ADDITION, THE MEASUREMENT IS NOT ON C&W BUT ON SYSTEM MANAGEMENT AND MAY NOT ALERT CREW TO HAZARD DURING SLEEP PERIOD.

HAZARD NUMBER 1YXX-0503-23

HAZARD EFFECTS

WHEN SCRUBBERS FAIL TO REMOVE CO₂, THE CO₂ LEVEL MAY INCREASE AT A FAST RATE. CO₂ LEVEL ABOVE 3% MAY CAUSE SEVERE MEDICAL PROBLEMS RESULTING IN CREW UNCONSCIOUSNESS.

RELATED HAZARD ANALYSES

1ZXX-0601-01-01

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD J.H.COLEGROVE

SAFETY LEAD W.E.PLAISTED

DISPOSITION

RESP GRP ACTION DOCUMENTATION

PRELIMINARY ANALYSIS INDICATES THAT THE CARBON DIOXIDE LEVEL WOULD NOT INCREASE TO A DANGEROUS LEVEL DURING THE REPLACEMENT INTERVAL. THERE IS A CO₂ CREW ALERT PARAMETER IN THE SYSTEMS MANAGEMENT NETWORK. IN ADDITION TO ALERTING THE CREW, THIS SIGNAL WILL BE TELEMETERED TO A GROUND STATION.

CLOSURE RATIONALE

THE ABOVE CORRECTIVE ACTION HAS BEEN CONFIRMED, THEREFORE THIS HAZARD IS CLOSED.

HA-TRACK

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HAZARD ANALYSIS NUMBER	SUBSYSTEM/EQUIPMENT OR OPERATION	LEVEL INIT	HZD TRACK CAT	HAZARD STATUS	ENTRY DATE
1YXX-0503-24	DISPLAYS-CONTROLS	CA	12	DELETED	32675

HAZARD DESCRIPTION

LOSS OF FLIGHT CONTROL SYSTEM AND DOWNGRADING FROM AUTOMATIC TO
MANUAL MODE DOES NOT RESULT IN VEHICLE CONTROL RECOVERY.
(DELETED AND INCORPORATED INTO 1YXX-0505-02)

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HA-TRACK

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HAZARD ANALYSIS NUMBER	SUBSYSTEM/EQUIPMENT OR OPERATION	LEVEL INIT	HDZ TRACK	HAZARD CAT	STATUS	ENTRY DATE
1YXX-0505-02	DATA PROC.SYS-SOFTWR	CA	CN/CN	123	CONTROLLED	102174

HAZARD DESCRIPTION

SINGLE FAULT LOADED INTO GENERAL PURPOSE COMPUTER APPEARS IN ALL GPC MEMORIES

FLIGHT TEST GROUND TEST FERRY FLIGHTS ORBITAL MISSION OTHER X
GROUND OPERATIONS
PRELAUNCH X LIFT OFF THRU ORBIT ON ORBIT DE-ORBIT THRU LANDING

HAZARD GROUP FF LOSS OF FLIGHT CONTROL **RESP.ENGR. R.F.RAASCH**

RELATED FMEAS ----- **FMEA REQD YES NO**
----- ----- ----- -----
NONE ----- ----- ----- ----- **X**

REFERENCES

NONE

HAZARD CAUSES

- 01-READ-IN/READ OUT ERROR FROM COMPUTER MEMORY
 - 02-INADVERTENT SOFTWARE BRANCHING
 - 03-ERROR IN SOFTWARE (PROGRAM TAPES) PROGRAMMED DATA
 - 04-CONFIGURATION (HARDWARE-TO-SOFTWARE) MISMATCH

HAZARD NUMBER 1YXX-0505-02

HAZARD EFFECTS

ABBERATIVE PROPULSION/FLIGHT CONTROL COMMAND COULD RESULT IN LOSS OF VEHICLE AND PERSONNEL

RELATED HAZARD ANALYSES

1AXX-0505-01, 1YXX-0507-04, 1YXX-0503-24, 1YXX-0507-05

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD

SAFETY LEAD W.E.PLAISTED

DISPOSITION

RESP GRP ACTION DOCUMENTATION

BFCS IN OV-102 & SUBS CAN
ALLEVIATE IMPACT OF SINGLE
FAULT IN PFCS SOFTWARE

382-360 MCR 2634

CLOSURE RATIONALE

THIS HAZARD IS CLOSED AS MCR 2634 IMPLEMENTS A BACKUP FLIGHT CONTROL SYSTEM WITH DEDICATED AVIUNIC HARDWARE AND DEDICATED SOFTWARE

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HA-TRACK

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1

HAZARD ANALYSIS SUBSYSTEM/EQUIPMENT NUMBER	LEVEL OR OPERATION	INIT TRACK	HZD CAT	HAZARD STATUS	ENTRY DATE
1ZXX-0505-03	DATA PROC. SYSTEM	CR	CN/CN 2	CONTROLLED	022175

HAZARD DESCRIPTION

OVERLOADING OF SPACECRAFT ONBOARD COMPUTER CAPACITY

FLIGHT TEST GROUND TEST FERRY FLIGHTS ORBITAL MISSION OTHER
Prelaunch X LIFT OFF THRU ORBIT X ON ORBIT X DE-ORBIT THRU LANDING X

HAZARD GROUP FF LOSS OF FLIGHT CONTROL RESP ENGR R.F.RAASCH

RELATED FMEAS

NONE

FMEA REQD YES NO

X

REFERENCES

SOFTWARE FSSR'S

HAZARD CAUSES

- 01-FAILURE TO REMOVE INPUTS NOT BEING USED
- 02-FAILURE TO ADJUST MISSION TO COMPUTER CAPABILITIES AFTER REDUNDANT/BACKUP COMPUTER FAILURES

HAZARD EFFECTS

FUNCTIONAL OPERATIONS ANOMOLIES IF CAPACITY EXCEEDED

RELATED HAZARD ANALYSIS

NONE

HAZARD NUMBER 1ZXX-0505-03

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD -INTERFACE

SAFETY LEAD W.E.PLAISTED

DISPOSITION

RESP GRP ACTION DOCUMENTATION

SEE CLOSURE RATIONALE

CLOSURE RATIONALE

THIS HAZARD IS CLOSED AS THE "HAISE SCRUB" ADDRESSED THE OVERLOADING PROBLEM BY IMPLEMENTING A SOFTWARE PARTITIONING SCHEME WHEREIN THERE ARE SEPARATE LOADS FOR: ASCENT, ON-ORBIT, AND DESCENT. THESE LOADS ARE RESIDENT IN THE MASS MEMORY AND ARE TRANSFERRED IN/OUT OF THE GPC MEMORIES - DURING QUIESCENT PERIODS - AS THE MISSION NEEDS DICTATE

SAIL SIMULATION WILL ADDRESS ABILITY OF COMPUTER SYSTEM SIZING TO ACCOMMUDATE MISSION SOFTWARE LOADING.

HA-TRACK

01/27/77 PAGE 1

HAZARD ANALYSIS NUMBER	SUBSYSTEM/EQUIPMENT OR OPERATION	LEVEL INIT TRACK	HZD CAT	HAZARD STATUS	ENTRY DATE
1ZXX-0505-04	DATA PROC HWE - DBC	CA	CN/CN 12	CONTROLLED	051575

HAZARD DESCRIPTION

IGNITION SOURCE - DATA BUS COUPLER

FLIGHT TEST	GROUND TEST	FERRY FLIGHTS	ORBITAL MISSION	OTHER X
ALL MISSION PHASES				
PRELAUNCH	LIFT OFF THRU ORBIT	ON ORBIT	DE-ORBIT THRU LANDING	

HAZARD GROUP CC FIRE/EXPLOSION

RESP.ENGR R.F.RAASCH

RELATED FMEAS

NONE

FMEA REQD YES NO

X

REFERENCES

MC409-0020

HAZARD CAUSES

- 01-COMPONENT SHORTING
- 02-EXTERNAL SURFACE TEMPERATURE IN EXCESS OF 352 DEGREES F
- 03-ARCING AND SPARKING

HAZARD EFFECTS

LOSS OF VEHICLE & PERSONNEL FOLLOWING EXPLOSION

134

S
D
7
7
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-
0
6

HAZARD NUMBER 1ZXX-0505-04

RELATED HAZARD ANALYSES

NONE

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD R.MATAKEDA

SAFETY LEAD W.E.PLAISTED

DISPOSITION

01-03 ANALYSIS IS REQUIRED TO
ENSURE THAT THE DBC IS NOT AN
IGNITION SOURCE IN ITS NOMINAL
AND ANOMOLOUS OPERATIONS PER
SD74-SH-0223B

RESF GRP ACTION DOCUMENTATION

383-410 SD74-SH-0223B

135

SD74-SH-0001-06

CLOSURE RATIONALE

HAZARD IS CLOSED AS ANALYSIS INDICATES THAT THE HIGHEST
TEMPERATURE TO BE REACHED ON SURFACE OF DATA BUS COUPLER DOES
MEET THE 352 DEGREES F SPECIFIED IN "ORBITER FIRE/TOXICITY SAFE-
TY REQUIREMENTS" - SD74-SH-0223, REF: SINGER KEARFOTT Y258A355
"THERMAL ANALYSIS" AND IL 383-410-75-346 DATED 12 JUNE 1975

HAZARD DISPOSITION CONCURRENCE

FUNCTIONAL SUPERVISION DEP-GRP DATE SAFETY SUPERVISION DATE

F.W.SPRINGE

F.J.ATTAWAY 071075

HA-TRACK

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HAZARD ANALYSIS NUMBER	SUBSYSTEM/EQUIPMENT OR OPERATION	LEVEL INIT	HZD TRACK CAT	HAZARD STATUS	ENTRY DATE
1YXX-0506-03	EPDCC-PYRO SYSTEM	CA	CN/CN	012 CONTROLLED	070974

HAZARD DESCRIPTION

MISFIRE OF NLG DEPLOY PYRO

FLIGHT TEST GROUND TEST FERRY FLIGHTS ORBITAL MISSION X OTHER
PRELAUNCH LIFT OFF THRU ORBIT X ON ORBIT X DE-ORBIT THRU LANDING X

HAZARD GROUP FF LOSS OF FLIGHT CONTROL RESP.ENGR. R.F.RAASCH

RELATED FMEAS

05-6B

FMEA REQD YES NU

X

REFERENCES

NONE

HAZARD CAUSES

- 01-SHORT CIRCUIT
- 02-INADVERTENT ACTUATION
- 03-LOSS OF ELECTRICAL POWER

HAZARD EFFECTS

INABILITY TO SAFELY ENTER ATMOSPHERE/OR FAILURE DURING ENTRY OF
ATMOSPHERE: LOSS OF VEHICLE AND/OR CREW

RELATED HAZARD ANALYSES

1ZXX-0207-2B-01, 1ZXX-0207-2C, 1ZXX-0207-11A

136

5077-11-000-100

HAZARD NUMBER 1YXX-0506-03

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD J.LIVINGSTON

SAFETY LEAD W.E.PLAISTED

DISPOSITION

RESP GRP ACTION DOCUMENTATION

01-PROVIDE SHORT CIRCUIT IMMUNE
INITIATE CIRCUITRY (PRESENT
PYROS EMPLOY CAPACITIVE CHARGE
FOLLOWING "ARM" INITIATE) PYRO
FIRE CIRCUITRY IS SHIELDED TO
PREVENT EMI "FIRE" INITIATE

392-610 VS70-510101

02-ACTUATE SWITCH (COMMANDER AND
COPILOT POSITIONS) SPRING
LOADED AND GUARDED TO PREVENT
INADVERTENT ACTUATION

392-610 VS70-510101

03-DUAL INITIATION SYSTEMS ARE
INSTALLED TO INITIATOR (PILOT
STATION & COPILOT STATION)

392-610 VS70-510101

CLOSURE RATIONALE

HAZARD HAS BEEN CLOSED AS ABOVE DESIGN REQUIREMENTS HAVE BEEN
IMPLEMENTED PER VS70-510101

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SD77-SW-0001-06

HA-TRACK

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HAZARD ANALYSIS NUMBER	SUBSYSTEM/EQUIPMENT OR OPERATION	LEVEL INIT	HZD CAT	HAZARD STATUS	ENTRY DATE
1YXX-0506-04	EPDEC-EVENTS CONTROL	CA	CA/CN 123	IN-WORK	080674

HAZARD DESCRIPTION

INADVERTENT PYRO FIRING/MISFIRING

FLIGHT TEST	GROUND TEST	FERRY FLIGHTS	ORBITAL MISSION	OTHER X
ALL MISSION PHASES				
PRELAUNCH	LIFT OFF THRU ORBIT	ON ORBIT	DE-ORBIT THRU	LANDING

HAZARD GROUP FF LOSS OF FLIGHT CONTROL RESP ENGR R.F.RAASCH

RELATED FMEAS

05-6-2001,20034,20500-20512

FMEA REQD YES NO

REFERENCES

MC134 REV A -SEE CAUSES NOTED, MC450-0016, MC450-0040, MF0004-020

HAZARD CAUSES

- 01-UNNECESSARILY EARLY ARMING OF SYSTEMS (#2)
- 02-SEPARATION SENSORS WITH INADEQUATE TRAVEL TRIGGERED BY STRUCTURAL DEFLECTIONS (#33)
- 03-ALLOWING SIGNAL TO BE GENERATED BY MALFUNCTION OF A SINGLE SEPARATION SENSOR (#33)
- 04-UNNECESSARY DELAY IN DISARMING SYSTEMS WHEN THEY ARE NO LONGER NEEDED (#62)
- 05-ELECTRICAL TEST EQUIPMENT WITH VOLTAGE SOURCES HIGH ENOUGH TO FIRE PYRO DEVICES (#176)

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SD77-SH-0001-06

HAZARD NUMBER 1YXX-0506-04

- 06-UNCONTROLLED OR INSUFFICIENTLY VERIFIED TEST TECHNIQUES USED TO DEMONSTRATE PYRO DEVICE INSENSITIVITY TO INITIATION BY STATIC CHARGES - TEST CAN PERMANENTLY LOWER RESISTANCE OF PYRO DEVICE TO INITIATION BY SUBSEQUENT STATIC CHARGES (#221)
07-HYGROSCOPIC MATERIALS IN CLOSE PROXIMITY TO EXPLOSIVES OR FIRING CIRCUITS (#260)
08-SNEAK CIRCUIT DURING UNGROUNDING SEQUENCE OF VEHICLE AT LIFT-OFF (#9)
09-FAILURE TO DEADFACE CIRCUITS INTERRUPTED BY GUILLOTINE CUTTERS AND PREVENT REMAINING PYRO FIRING (#44)
10-USE OF SHARED ARM/FIRE CIRCUITRY (#237)
11-FAILURE TO PROVIDE CONSPICUOUS IDENTIFICATION, BY COLOR CODE, OF ALL PYROTECHNIC DEVICES NOT INTENDED FOR FLIGHT USE (#211)
12-INABILITY TO CHECKOUT PYROTECHNIC CIRCUITS AFTER INSTL(7.1.6)
13-INADEQUATE ISOLATION OF PYROTECHNIC WIRING FROM THE OTHER SPACECRAFT WIRING(7.1.7)

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HAZARD EFFECTS

OFF DESIGN FIRING COULD CAUSE DAMAGE TO EQUIPMENT AND/OR LOSS OF ORBITER & PERSONNEL

RELATED HAZARD ANALYSIS

1A6X-0506-01, 1A6X-0506-02, 1YXX-0506-03, 1ZXX-0506-15

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD KEN NICHOLS

SAFETY LEAD W.E.PLAISTED

DISPOSITION

- 01-REQUIRE SPECIAL PROCEDURES
02-SEPARATION SENSORS NOT USED
03-SEE 02-ABOVE

RESP GRP ACTION DOCUMENTATION

NASA MISSION PROCEDURES

SDS-22-S-000-106

HAZARD NUMBER 1YXX-0506-04

04-REQUIRE SPECIAL PROCEDURES	NASA	MISSION PROCEDURES
05-REQUIRE SPECIAL PROCEDURES	NASA	TEST & CHECKOUT PROC
06-REQUIRE SPECIAL PROCEDURES		TEST & CHECKOUT PROC
07-INTERFACE-SEE HA 1ZXX-0506-23		
08-SNEAK CIRCUIT ANALYSIS IN PROCESS		
09-INTERFACE SEE HA 1ZXX-0506-10		
10-SHARED ARM/FIRE CIRCUITRY NOT EMPLOYED IN DESIGN		VS70-760502
11-REQUIRE SPECIAL PROCEDURES	NASA	TEST & CHECKOUT PROC
12-REQUIRES SPECIAL PROCEDURES		
13-WIRING TO BE SHIELDED PER NASA JSC 08060		

HAZARD ANALYSIS NUMBER	SUBSYSTEM/EQUIPMENT OR OPERATION	LEVEL	HZD INIT TRACK CAT	HAZARD STATUS	ENTRY DATE
1ZXX-0506-05	EPDCC-EVENTS CONTROL	CR	CN/CN 12	CONTROLLED	071174

HAZARD DESCRIPTION

INABILITY TO CLOSE SPEED BRAKE-ELECTRICAL CONTROL

FLIGHT TEST PRELAUNCH	GROUND TEST LIFT OFF THRU ORBIT	FERRY FLIGHTS ON ORBIT	ORBITAL MISSION DE-ORBIT THRU LANDING	OTHER X
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HAZARD GROUP FF LOSS OF FLIGHT CONTROL	RESP.ENGR. K.RAASCH
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RELATED FMEASFMEA REQD YES NO

05-6EC

X

REFERENCES

NONE

HAZARD CAUSES

01-LACK OF ELECTRICAL CONTROL/POWER

HAZARD EFFECTSLOSS OF ENERGY/INABILITY TO REACH LANDING AREA, LOSS OF ORBITER
AND CREWRELATED HAZARD ANALYSES

1ZXX-0209-04-03

HAZARD NUMBER 12XX-05C6-05

HAZARD IDENTIFICATION CONCURRENCE

DISPOSITION

RESP GRP ACTION DOCUMENTATION

01-PROVIDE REDUNDANT POWER AND/OR 392-610 VS70-790531
CONTROL TO SPEED BRAKE ACTUATOR PER VS70-790531

CLOSURE RATIONALE

HAZARD CLOSED AS REDUNDANT POWER AND ACTUATION HAVE BEEN PROVIDED
PER VS70-790531

HAZARD DISPOSITION CONCURRENCE

FUNCTIONAL SUPERVISION	DEP-GRP	DATE	SAFETY SUPERVISION	DATE
L-UPDEGRAFF	392-610	C62075	F.J.ATTAWAY	071075

HA-TRACK

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HAZARD ANALYSIS NUMBER	SUBSYSTEM/EQUIPMENT OR OPERATION	LEVEL	HZD INIT TRACK CAT	HAZARD STATUS	ENTRY DATE
1ZXX-0506-06	ELECT.PWR.DIST & CON	CA	CN/CN 123	CONTROLLED	C10375

HAZARD DESCRIPTION

FAILURE TO REQUIRE REDUNDANT RELAYS IN CRITICAL CIRCUITS

FLIGHT TEST	GROUND TEST	FERRY FLIGHTS	ORBITAL MISSION	OTHER	X
ALL MISSION PHASES					
PRELAUNCH	LIFT OFF THRU ORBIT	ON ORBIT	DE-ORBIT THRU	LANDING	

HAZARD GROUP FF LOSS OF FLIGHT CONTROL RESP.ENGR. R.F.RAASCH

RELATED FMEAS

FMEA REQD YES NO

ALL 05-SERIES FMEAS

X

REFERENCES

MSC 00134 REV A #103

HAZARD CAUSES

01-LACK OF APPLICATION OF FO/FS OR FS CRITERIA TO CRITICAL CIRCUITRY

HAZARD EFFECTS

EQUIPMENT DAMAGE UP TO LOSS OF VEHICLE AND/OR CREW

RELATED HAZARD ANALYSES

NONE

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SD77-SH-0001-06

HAZARD NUMBER 1ZXX-0506-06

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD J.BEEKMAN

SAFETY LEAD W.E.PLAISTED

DISPOSITION

01-RELIABILITY REDUNDANCY PROGRAM
IS APPLIED TO ORBITER DESIGN
AS A PROGRAM DISCIPLINE TO
ENSURE A MINIMUM OF "FAIL
SAFE" CRITERIA IMPLEMENTED
PER MCR 955

RESP GRP ACTION DOCUMENTATION

394-100 MCR-955

144

CLOSURE RATIONALE

HAZARD CLOSED AS REDUNDANCY IS REQUIRED IN ALL CRITICAL CIRCUITS
PER MCR 955/ NHB 5300.4.1D301

HAZARD DISPOSITION CONCURRENCE

FUNCTIONAL SUPERVISION DEP-GRP DATE SAFETY SUPERVISION DATE

H.SAKAI

394-103 062075

F.J.ATTAWAY

071075

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HAZARD ANALYSIS NUMBER	SUBSYSTEM/EQUIPMENT OR OPERATION	LEVEL INIT	HZD TRACK	HAZARD CAT	STATUS	ENTRY DATE
1ZXX-0506-07	ELEC.PWR.DIST.& CON	CR	CN/CN	23	CONTROLLED	010375

HAZARD DESCRIPTION

IMPROPER LOCKING & SECURING OF ELECTRICAL CONNECTORS ON
INSTALLATION

FLIGHT TEST	GROUND TEST	FERRY FLIGHTS	ORBITAL MISSION	OTHER	X
ALL MISSION PHASES					
PRELAUNCH	LIFT OFF THRU ORBIT	ON ORBIT	DE-ORBIT THRU	LANDING	

HAZARD GROUP XX EQUIPEMT DAMAGE**RESP ENGR R.E.RAASCH****RELATED FMEAS****FMEA REQD YES NO**

NONE

X

REFERENCES

MSC 00134 REV A #100

HAZARD CAUSES

IMPROPER INSTALLATION TECHNIQUES

HAZARD EFFECTS

EQUIPMENT DAMAGE

RELATED HAZARD ANALYSIS

1ZXX-0506-15

HAZARD NUMBER 1ZXX-0506-07

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD J.BERNICH

SAFETY LEAD W.E.PLAISTED

DISPOSITION

RESP GRP ACTION DOCUMENTATION

CONNECTORS ARE LOCKED AND SECURED 392-350 ML0303-0014 PER
PER PARAGRAPH 4.2. OF ML0303-0014 (SEE CLOSURE)

CLOSURE RATIONALE

HAZARD CLOSED AS CORRECTIVE ACTION IS BEING IMPLEMENTED BY THE
ML0303-0014 CALL OUT ON THE FOLLOWING DRAWINGS:

V070-793001 CREW MODULE ELECTRICAL INSTL
V070-792001 LOWER FUSELAGE ELECTRICAL INSTL
V070-794000 MID FUSELAGE ELECTRICAL INSTL
V070-795000 AFT FUSELAGE ELECTRICAL INSTL
V070-796000 WING ELECTRICAL INSTL
V070-797000 VERTICAL ELECTRICAL INSTL

HAZARD DISPOSITION CONCURRENCE

FUNCTIONAL SUPERVISION DEP-GRP DATE SAFETY SUPERVISION DATE

A.E.ROPER 392-350 061975 F.J.ATTAWAY 071075

HA-TRACK

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HAZARD ANALYSIS SUBSYSTEM/EQUIPMENT NUMBER	LEVEL OR OPERATION	INIT	HZD TRACK	CAT	HAZARD STATUS	ENTRY DATE
1ZXX-0506-08	ELECT.PWR.DIST.& CON	CA	CA/CN	123	IN WORK	011675

HAZARD DESCRIPTION

OFF SCHEDULE "ARMING" OR "DISARMING" OF SYSTEMS

FLIGHT TEST ALL MISSION PHASES	GROUND TEST PRELAUNCH	FERRY FLIGHTS LIFT OFF THRU ORBIT	ORBITAL MISSION ON ORBIT	OTHER DE-ORBIT THRU LANDING
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HAZARD GROUP FF LOSS OF FLIGHT CONTROL RESP.ENGR. R.F.RAASCH

RELATED FMEAS

NONE

FMEA REQD YES NO

X

REFERENCES

MSC 00134 REV A #2, #02, MCR 1816

HAZARD CAUSES

01-SOFTWARE (PROGRAMMED DATA) IN ERROR OR ABSENT
02-PROCEDURAL DATA (MAN-MACHINE) IN ERROR OR ABSENT

HAZARD EFFECTS:

POSSIBLE LOSS OF VEHICLE AND OR PERSONNEL

RELATED HAZARD ANALYSIS

1ZXX- AND 1YXX- 0506 AND 0507 SERIES

HAZARD NUMBER 1ZXX-0506-08

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD -INTERFACE

SAFETY LEAD W.E.PLAISTED

DEPOSITION

RESP GRP ACTION DOCUMENTATION

01-MCR 1816 ESTABLISHES SOFTWARE
WORKING GROUP TO EVALUATE
UTILITY DATA FLOW - GUIDANCE,
NAVIGATION AND CONTROL/SYSTEM
MANAGEMENT - GROUND OPERATIONS
AND THE NASA/IBM GENERATED
FLIGHT TAPE

397 MCR 1816

02-SUMMARIZE "MISSION PROCEDURES"
FROM ALL HA'S THAT RELATE TO
ARMING/DISARMING SYSTEM AND
INCORPORATE IN FLIGHT DATA FILE

FLIGHT DATA FILE

HAZARD ANALYSIS SUBSYSTEM/EQUIPMENT NUMBER	LEVEL OR OPERATION	INIT	HZD TRACK	CAT	HAZARD STATUS	ENTRY DATE
1ZXX-0506-09	ELECT.PWR.DIST.& CON	CR	CN/CN	23	CCNTROLLED	011675

HAZARD DESCRIPTION

FAILURE TO PROTECT POWER SUPPLIES FROM SHORT CIRCUITS IN PYRO-
TECHNIC DEVICES AFTER FIRING

FLIGHT TEST	GROUND TEST	FERRY FLIGHTS	ORBITAL MISSION	OTHER X
ALL MISSION PHASES				
PRELAUNCH	LIFT OFF THRU ORBIT	ON URBIT	DE-ORBIT THRU LANDING	

HAZARD GROUP XX EQUIPMENT DAMAGERESP.ENGR. R.F.RAASCHRELATED FMEASFMEA REQD YES NO

NONE

X

REFERENCES

MSC 00134 REV A #45, MC450-0018

HAZARD CAUSES

IMPROPER CIRCUIT PROTECTION

HAZARD EFFECTS

EQUIPMENT DAMAGE

RELATED HAZARD ANALYSIS

NONE

HAZARD NUMBER 1ZXX-0506-09

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD KEN NICHOLS

SAFETY LEAD W.E.PLAISTED

DISPOSITION

RESP GRP ACTION DOCUMENTATION

PYRO INITIATOR CONTROLLER REMOVES
ARMING POWER AT FIRING PER
SK5A1100001 AND REMOVAL OF FIRING
SIGNALS OPENS BOTH LEGS OF INITI-
ATOR CIRCUIT. THREE FAILURES RE-
QUIRED TO ELIMINATE POWER SUPPLY
PROTECTION

392-610 SK5A1100001

CLOSURE RATIONALE

HAZARD CLOSED BASED ON IMPLEMENTATION OF THE CORRECTIVE ACTION
NOTED ABOVE PER SK5A1100001

HAZARD DISPOSITION CONCURRENCE

FUNCTIONAL SUPERVISION	DEP-GRP	DATE	SAFETY SUPERVISION	DATE
L.A.UPDEGRAFF	392-610	062075	F.J.ATTAWAY	071075

150

SD2-2-SII-0001-06

HAZARD ANALYSIS SUBSYSTEM/EQUIPMENT NUMBER	CR OPERATION	LEVEL	H2D INET TRACK CAT	HAZARD STATUS	ENTRY DATE
2XX-0500-10	ELECT. PHR. EISL. & CIN	CR	CR/CN .3	IN-WKRR	02/09/77

HAZARD DESCRIPTION

FAILURE TO DEADFALL KU-BAND RADAR DUE TO POWER CIRCUITS BEFORE
GUILLOTINING/JETTISONING.

FLIGHT TEST	GROUND TEST	FERRY FLIGHTS	ORBITAL MISSION	OTHER X
ALL MISSION PHASES				
PRELAUNCH	LIFT OFF THRU ORBIT	ON ORBIT	DE-ORBIT THRU LANDING	

HAZARD GROUP XX EQUIPMENT DAMAGE

RESP ENGR R.F.RAASCH

RELATED FMEAS

FMEA REQD YES NO

NONE

X

REFERENCES

MSL 00134 REV A P44

HAZARD CAUSES

NO PROVISION FOR DEADFALLING

HAZARD EFFECTS

EQUIPMENT DAMAGE

RELATED HAZARD ANALYSIS

NONE

ORIGINAL PAGE IS
OF POOR QUALITY

HA-TRAK

02/05/77 PAGE

HAZARD NUMBER 12XX 0506-10

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD KEN NICHOLS

DISPOSITION

PROCEDURE REQUIRED TO PULL
CIRCUIT BREAKER PRIOR TO BLOOM
JETTISONING

SAFETY LEAD W.E. PLAISTED

RESP GRP ACTION DOCUMENTATION

FLIGHT DATA FILE
PROCEDURES

HAZARD ANALYSIS NUMBER	SUBSYSTEM/EQUIPMENT OR OPERATION	LEVEL	H2D INIT TRACK CAT	HAZARD STATUS	ENTRY DATE
1ZXX-0506-11	ELECT.PWR.DIST.& CUN	CR	CN/CN 23	CONTROLLED	080274

HAZARD DESCRIPTION

MATING/DEMATING ELECTRICAL CONNECTORS WITHOUT REMOVING VOLTAGES
FROM THE POWERED SIDE OF THE CONNECTOR

FLIGHT TEST X GROUND TEST X FERRY FLIGHTS ORBITAL MISSION OTHER
PRELAUNCH X LIFT OFF THRU ORBIT ON ORBIT DE-ORBIT THRU LANDING

HAZARD GROUP XX DAMAGE TO EQUIPMENT RESP ENGR R.F.RAASCH

EST

RELATED FMEAS FMEA REQD YES NO

NONE

REFERENCES

MSC 00134 REV A #43

60-1000-001-220

HAZARD CAUSES

01-UMBILICALS DISCONNECTED WHILE HOT
02- NO PROCEDURAL ACCOMMODATION TO SHUTDOWN EQUIPMENT PRIOR TO
DEMATING/MATING CONNECTORS

HAZARD EFFECTS

DAMAGE TO EQUIPMENT - POSSIBLE IGNITION SOURCE

RELATED HAZARD ANALYSIS

NONE

HAZARD NUMBER 1ZXX-0506-11

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD TOM QUEBEDEAUX SAFETY LEAD W.E.PLAISTED

DISPOSITION

RESP GRP ACTION DOCUMENTATION

SEE CLOSURE RATIONALE

CLOSURE RATIONALE

THIS HAZARD IS CLOSED AS THE FOLLOWING IS CALLED OUT IN ALL TEST & CHECKOUT PROCEDURES: "G. ELECTRCIAL CONNECTIONS SHALL NOT BE MATED/DEMATED WHILE VOLTAGE IS APPLIED TO CONNECTORS."

HAZARD ANALYSIS NUMBER	SUBSYSTEM/EQUIPMENT OR OPERATION	LEVEL INIT TRACK CAT	HZD CN/CN 12	HAZARD STATUS	ENTRY DATE
1YXX-0506-12	ELECT.PWR.DISTR&CON.	CA	CONTROLLED C50575		

HAZARD DESCRIPTION

ET DOOR POWERING INVERTER FAILURE DURING RTLS ABURT IMPACT UN
RETURN TO SITE

FLIGHT TEST PRELAUNCH	GROUND TEST LIFT OFF THRU ORBIT X ON ORBIT	FERRY FLIGHTS X ON ORBIT	ORBITAL MISSION DE-ORBIT THRU LANDING	OTHER
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HAZARD GROUP FF LOSS OF FLIGHT CONTROLS RESP.ENGR. R.F.RAASCH

RELATED FMEAS**FMEA REQD YES NO**

NONE

X

REFERENCES

RELIABILITY-AC POWER DISTRIBUTION SYSTEM LOAD ANALYSIS
V560102

HAZARD CAUSES

- 01-LOSS OF INVERTER POWERING ET DOORS(AND)
- 02-DOOR CLOSING TIMELINE IS EXTENDED (AND)
- 03-HIGH AERODYNAMIC PRESSURE DAMAGE TO ET DOOR
- 04-INCREASE AERODYNAMIC DRAG TO ORBITER

HAZARD EFFECTS

INABILITY TO CLOSE ET DOOR COULD CAUSE AN AERODYNAMIC DRAG AND
OR BUFFET SUFFICIENT IN MAGNITUDE TO PREVENT ABILITY TO
TO RETURN TO SITE. LOSS OF VEHICLE AND PERSONNEL

HAZARD NUMBER 1YXX-0506-12

RELATED HAZARD ANALYSIS

NONE

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD -INTERFACE-

SAFETY LEAD W.E.PLAISTED

DISPOSITION

THE COMPRESSION LOADS ON THE ET
DOOR LINKAGES ARE ALLEVIATED BY
ADDING A TORQUE LIMITING OR
DECLUTCHING DEVICE

RESP GRP ACTION DOCUMENTATION

MC287-0020
PARA 3.2.1.2.1.2.1

CLOSURE RATIONALE

AFTER PITCH-UP DURING RTLS ABORT, THE DYNAMIC PRESSURE TENDS TO
CLOSE THE ET DOORS. IN THE PREVIOUS DESIGN, ANY MOTOR POWERING
FAILURE (THERE ARE TWO DRIVE MOTORS AND A DIFFERENTIAL DRIVE
TRAIN) WOULD TEND TO COMPRESS THE DOOR LINKAGES AGAINST THE
AERODYNAMIC DOOR CLOSING FORCE. SPECIFICATION REWRITE, AS NOTED,
CALLS FOR A TORQUE LIMITING OR DECLUTCHING DEVICE TO ALLOW THE
AERODYNAMIC PRESSURE TO AID IN DOOR CLOSING INSTEAD OF REACTING
AGAINST THE DOOR CLOSING MOTOR.

HA-TRACK

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HAZARD ANALYSIS NUMBER	SUBSYSTEM/EQUIPMENT OR OPERATION	LEVEL INIT	H2D TRACK CAT	HAZARD STATUS	ENTRY DATE
1ZXX-0506-13	ELECT.PWR.DIST & CON	CR	CN/CN 23	CONTROLLED	011775

HAZARD DESCRIPTION

CIRCUIT BREAKERS TOO LARGE OR SLOW ACTING TO PROTECT WIRING

FLIGHT TEST	GROUND TEST	FERRY FLIGHTS	CREITAL MISSION	OTHER	X
ALL MISSION PHASES					
PRELAUNCH	LIFT OFF THRU ORBIT	ON ORBIT	DE-ORBIT THRU	LANDING	.

HAZARD GROUP XX EQUIPMENT DAMAGE

RESP ENGR R.F.RAASCH

RELATED FMEAS

NONE

FMEA REQD YES NO

x

REFERENCES

MSC 00134 #3

HAZARD CAUSES

INADEQUATE DESIGN REQUIREMENTS

HAZARD EFFECTS

EQUIPMENT DAMAGE

RELATED HAZARD ANALYSIS

1ZXX-0506-24

157

SD77-SH-0001-06

HAZARD NUMBER 1ZXX-0506-13

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD TOM GUEBEDEAUX

SAFETY LEAD W.E.PLAISTED

DISPOSITION

RESP GRP ACTION DOCUMENTATION

SELECTION OF WIRE GAGE VS BREAKER
SIZE SPECIFIED IN IL TO DESIGNERS
"SELECTION OF WIRE GAGES (MB 0150
-048-KAPTON WIRE", 392-630-74-010
DTD 7 JUNE 1976-REVISED

392-330 IL392-330-74-010

CLOSURE RATIONALE

THIS HAZARD IS CLOSED BASED ON DESIGN DIRECTION TO CONCERNED
DESIGN GROUPS PRESENTED IN IL392-330-74-010 REV 7 JUNE 1976
AND VERIFIED BY DESIGN SUPERVISION

HAZARD DISPOSITION CONCURRENCE

FUNCTIONAL SUPERVISION	DEP-GRP	DATE	SAFETY SUPERVISION	DATE
L.A.UPDEGRAFF	392-330	062075	F.J.ATTAWAY	071075

HA-TRACK

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HAZARD ANALYSIS SUBSYSTEM/EQUIPMENT NUMBER	LEVEL OR OPERATION	INIT	H2D TRACK	CAT	HAZARD STATUS	ENTRY DATE
1ZXX-0506-14	ELECT.PWR.DIST.& CON	CR	CR/CN	23	IN WORK	C10375

HAZARD DESCRIPTION

POWERING UP SYSTEMS WITH LATCHING RELAYS IN UNKNOWN POSITIONS

FLIGHT TEST GROUND TEST FERRY FLIGHTS ORBITAL MISSION X OTHER
PRELAUNCH X LIFT OFF THRU ORBIT ON ORBIT DE-ORBIT THRU LANDING X

HAZARD GROUP XX EQUIPMENT DAMAGE

RESP ENGR R.F.RAASCH

RELATED FMEAS

FMEA REQD YES NO

NONE

X

REFERENCES

MSC 00134 REV A #99, #156

HAZARD CAUSES

01-LATCHING RELAYS SWITCHED BY TRANSIENTS TO AN UNPLANNED CONFIGURATION

HAZARD EFFECTS

EQUIPMENT DAMAGE

RELATED HAZARD ANALYSIS

NONE

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HAZARD NUMBER 1ZXX-0506-14

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD TOM QUEBEDEAUX

SAFETY LEAD W.E.PLAISTED

DISPOSITION

LATCHING RELAYS IN DC/AC APPLICATIONS (POWER SWITCHING) HAVE AUXILIARY CONTACTS USED FOR POSITION INDICATION OF CONTACTORS

RESP GRP ACTION DOCUMENTATION

392-600 DESIGN PRACTICE

CONTACTOR POSITION CAN BE CALLED UP ON CRT/BARBER POLE INDICATORS

MISSION PROCEDURES

REMOTE CONTROL CIRCUIT BREAKERS CONTROL POWERED FROM ESSENTIAL BUS. POSITIONING IS A PROCEDURAL FUNCTION.

MISSION PROCEDURES

HAZARD ANALYSIS SUBSYSTEM/EQUIPMENT NUMBER	LEVEL OR OPERATION	INIT	HLD	HAZARD STATUS	ENTRY DATE
1ZXX-0506-15	EPDEC-URBITER WIRING	CR	CN/CN	123 CONTROLLED	010375

HAZARD DESCRIPTION

DAMAGE SUSCEPTIBILITY TO ORBITER WIRING HARNESS

FLIGHT TEST	GROUND TEST	FERRY FLIGHTS	URBITAL MISSION	OTHER	X
ALL MISSION PHASES					
PRELAUNCH	LIFT OFF THRU ORBIT	ON ORBIT	DE-ORBIT THRU	LANDING	

HAZARD GROUP XX EQUIPMENT DAMAGE

RESP ENGR R.F.RAASCH

RELATED FMEAS

FMEA REQD YES NO

NONE

X

REFERENCES

MSC 00134 REV A #152, #174, #175, #93, #162, #150, #160, #180,
MF0004-020, MCR 2931

HAZARD CAUSES

- 01-UNPROTECTED WIREWAYS IN TRAFFIC AREAS (#152)
- 02-CLAMPING DISTANCES TOO LARGE TO PREVENT VIBRATION (#175)
- 03-SHARP WIRE TURNS ADJACENT TO CONNECTORS
- 04-ELECTRIC WIRING IN CONTACT WITH FLUID LINES/TANKS (#174)
- 05-FLAMMABLE POTTING IN ELECTRICAL CONNECTORS (#93)
- 06-CIRCUIT BREAKERS AND SWITCHES WITH FLAMMABLE CASES OR
- 07-POWER SYSTEM SURGES OUTSIDE TOLERABLE LIMITS RESULTING FROM EQUIPMENT TURN-ON OR TURN-OFF (#150)

HAZARD NUMBER 1ZXX-0506-15

- 08-HIGH RESISTANCE COATING DEPOSITED ON ELECTRICAL CONTACTS FROM OUTGASSED PRODUCTS OF POTTING COMPOUNDS AT ELEVATED TEMPERATURES AND LOW PRESSURES (#160)
09-SOLID WIRE (SINGLE STRAND) USE IN LOCATION SUSCEPTIBLE TO FLEXING.
10-SHARP EDGES THAT CAN CONTACT UNPROTECTED WIRE INSTAL.
11-HARNESS LENGTH AND ACCESS DOESN'T ALLOW DISCONNECT/RECONNECT OF WIRING OR CONNECTORS.

HAZARD EFFECTS

IF NOT DISCOVERED IN TIME, LOSS OF VEHICLE AND PERSONNEL

RELATED HAZARD ANALYSIS

1ZXX-0506-04, 1ZXX-0207-2B-C1, 1ZXX-0500-07

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD INTERFACE

SAFETY LEAD W.E.PLASTED

DISPOSITION

RESP GRP ACTION DOCUMENTATION

- 01,10-DESIGN APPROACH DOES NOT ALLOW
611 EXPOSED WIRES IN CREW MODULE, &
PAYLOAD BAY WIRES ARE IN SIDE
MOUNTED WIRE TRAYS.APPROVAL OF
WIRING MOCK-UP REQUIRED PER
PARAGRAPH 3.4.OF ML0303-0014
AFT FUS WIRING PER MCR 2931
02-SUPPORT AS SPECIFIED IN PARA
4.1.2 AND DESIGN INSPECTED PER
PARAGRAPH 3.4.OF ML0303-0014
03-MINIMUM BEND RADIUS PER PARA
3.5.6. OF ML0303-0014 FOR WIR-
ING HARNESS & COAXIAL CABLE

ML0303-0014

MCR 2931
ML0303-0014

HAZARD NUMBER 1ZXX-0506-15

04-SEPARATION REQUIREMENT PER
PARAGRAPH 4.1.1.3. OF ML0303-
0014. ML0303-0014

05-CONNECTORS PROCURED TO 40M-
38227, 40M38298, 40M39569. IN-
HOUSE CONNECTOR MATERIALS
SCREENED PER MF0004-003 MF0004-003

06-INTERFACE-SEE HA 1ZXX-0500-07
FLAMMABILITY SCREENING PER
MC999-0096 REQUIRED BY CPPL
(MF0004-400) MF0004-400

07-POWER PROFILE DEFINITION REQD
BY PARA 3.2 OF MF0004-002 IN
EACH EQUIPMENT SPECIFICATION.
MF0004-002

08-SEE 05-ABOVE

09-IT IS COMPANY POLICY TO EXCLUDE
SINGLE STRAND WIRE BUYS UNLESS
SPECIFICALLY JUSTIFIED

CLOSURE RATIONALE

HAZARD CLOSED PER INCLUSION OF REQUIREMENTS AND DESIGN SELECTION CRITERIA IN CORRECTIVE ACTION ABOVE PER ML0303-0014, CONNECTOR PROCUREMENT DOCUMENTS, MF0004-003 AND MF0004-002 AND AS CALLED OUT IN THE FOLLOWING DRAWINGS:

V070-793001 CREW MODULE ELECTRICAL INSTL
V070-792001 LOWER FORWARD FUSELAGE ELECTRICAL INSTL
V070-794000 MID FUSELAGE ELECTRICAL INSTL
V070-795000 AFT FUSELAGE ELECTRICAL INSTL
V070-796000 WING ELECTRICAL INSTL
V070-797000 VERTICAL ELECTRICAL INSTL

ORIGINAL PAGE IS
OF POOR QUALITY

HA-TRACK

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HAZARD NUMBER 1ZXX-0506-15

HAZARD DISPOSITION CONCURRENCE

FUNCTIONAL SUPERVISION DEF-GRP	DATE	SAFETY SUPERVISION	DATE
-INTERFACE-		F.J. ATTAWAY	071075

HAZARD ANALYSIS NUMBER	SUBSYSTEM/EQUIPMENT OR OPERATION	LEVEL	H2D INIT TRACK CAT	HAZARD STATUS	ENTRY DATE
1YXX-0506-16	EPDEC	CR	CN/CN 23	CONTROLLED	042875

HAZARD DESCRIPTION

FAILURE TO RELEASE LH₂/LG₂ UMBILICAL

FLIGHT TEST GROUND TEST FERRY FLIGHTS ORBITAL MISSION OTHER
PRELAUNCH LIFT OFF THRU ORBIT X ON ORBIT DE-ORBIT THRU LANDING

HAZARD GROUP XX EQUIPMENT DAMAGE

RESP.ENGR. R.F.RAASCH

RELATED FMEAS

FMEA REQD YES NO

NONE

X

REFERENCES

NONE

HAZARD CAUSES

IMPROPER SYSTEM DESIGN

HAZARD EFFECTS

EQUIPMENT DAMAGE

RELATED HAZARD ANALYSIS

NONE

HA-TRACK

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HAZARD NUMBER 1YXX-0506-16

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD KEN NICHOLS

SAFETY LEAD W.E.PLAISTED

DISPOSITION

REDUNDANT PYRO DEVICES REQUIRED

RESP GRF ACTION DOCUMENTATION

VS760501

CLOSURE RATIONALE

REDUNDANT METHODS TO RELEASE UMBILICAL ARE AVAILABLE. THIS
HAZARD IS CLOSED

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HAZARD ANALYSIS NUMBER	SUBSYSTEM/EQUIPMENT OR OPERATION	LEVEL	HZD INIT TRACK CAT	HAZARD STATUS	ENTRY DATE
1YXX-0506-17	ELECT PWR.DIST & CON	CR	CN/CN 2	CONTROLLED	041874

HAZARD DESCRIPTION

LOSS OF ELECTRICAL POWER/CONTROL TO REMUTELY ACTUATED DOORS

FLIGHT TEST PRELAUNCH	GROUND TEST LIFT OFF	FERRY FLIGHTS THRU ORBIT X	ORBITAL MISSION ON ORBIT	OTHER DE-ORBIT THRU LANDING X
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HAZARD GROUP FF LOSS OF FLIGHT CONTROL RESP ENGR R.F.RAASCH

RELATED FMEAS

NONE

FMEA REQD YES NO

X

REFERENCES

NONE

HAZARD CAUSES

01-LACK OF REDUNDANT CONTRUL/POWER OR BACK-UP SYSTEM

HAZARD EFFECTS

IF NOT CORRECTED, POSSIBLE LOSS OF VEHICLE AND CREW

RELATED HAZARD ANALYSIS

1ZXX-0201-1B; 1YXX-0204-1B; 1YXX-0204-2A ; 1YXX-C204-3A;
1YXX-0211-1A,-2A,-3A,-4A,-5A,-6A,-7A, 1YXX-C211-04-01

90-1000-US-2205

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HAZARD NUMBER 1YXX-0506-17

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD JIM LIVINGSTON

DISPOSITION

01-ADEQUATE POWER/CONTROL
PROVIDED PER THE NOTED WIRING
DIAGRAMS

SAFETY LEAD W.E.PLAISTED

RESP GRP	ACTION DOCUMENTATION
392-600	PAYLOAD BAY DOORS V540302 ET DOORS V560102 VENT DOORS V590502 STAR TRACKER DOOR V590202

CLOSURE RATIONALE

THIS HAZARD IS CLOSED AS REDUNDANT METHODS FOR DOOR POWER AND
CONTROL ARE AVAILABLE AS NOTED ABOVE

HA-TRACK

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HAZARD ANALYSIS SUBSYSTEM/EQUIPMENT NUMBER	LEVEL OR OPERATION	HZD INIT TRACK CAT	HAZARD STATUS	ENTRY DATE
1ZXX-0506-18	ELECT.PWR.DIST & CON	CA	CN/CN 123	CONTROLLED C41974

HAZARD DESCRIPTION

BRAKES (MAIN LANDING GEAR) FAIL TO ACTUATE OR ACTUATE ERRATICALLY

FLIGHT TEST	GROUND TEST	FERRY FLIGHTS	ORBITAL MISSION	OTHER
PRELAUNCH	LIFT OFF THRU ORBIT	ON ORBIT	DE-ORBIT THRU LANDING	X

HAZARD GROUP FF LOSS OF CONTROL

RESP ENGR R.F.RAASCH

RELATED FMEAS

NONE

FMEA REQD YES NO

X

REFERENCES

VS70-520101

HAZARD CAUSES

LACK OF REDUNDANT POWER/CONTROL CAPABILITY

HAZARD EFFECTS

DAMAGE TO VEHICLE, POSSIBLE LOSS OF PERSONNEL

RELATED HAZARD ANALYSIS

1ZXX-0201-3B, 1ZXX-0506-19

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HAZARD NUMBER 1ZXX-0506-18

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD JIM LIVINGSTON

SAFETY LEAD W.E.PLAISTED

DISPOSITION

RESP GRP ACTION DOCUMENTATION

THREE OF FOUR BRAKED WHEELS REQUIRED FOR SPEC STOPPING. EACH BOGIE HAS TWO BRAKING SYSTEMS CONTROLLABLE BY EITHER PILOT OR COPILOT PER VS70-520101

392-610 VS70-520101

CLOSURE RATIONALE

HAZARD CLOSED BASED ON REDUNDANT DESIGN AND OPERATIONAL OPTIONS AVAILABLE TO THE CREW IN THE EVENT OF BRAKE FAILURE AS SHOWN IN DRAWING VS70-520101

HAZARD DISPOSITION CONCURRENCE

FUNCTIONAL SUPERVISION DEP-GRP DATE SAFETY SUPERVISION DATE

L.A.UPDEGRAFF 392-610 062075 F.J.ATTAWAY 071075

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HA-TRACK

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HAZARD ANALYSIS NUMBER	SUBSYSTEM/EQUIPMENT OR OPERATION	LEVEL INIT TRACK	HZD CAT	HAZARD STATUS	ENTRY DATE
1ZXX-0506-19	ELECT.PWR.DIST.& CON	CA	CN/CN 123	CONTROLLED	041974

HAZARD DESCRIPTION

NOSE GEAR STEERING SYSTEM LOSS OF CONTROL

FLIGHT TEST	GROUND TEST	FERRY FLIGHTS	ORBITAL MISSION	OTHER
PRELAUNCH	LIFT OFF THRU ORBIT	ON ORBIT	DE-ORBIT THRU LANDING	X

HAZARD GROUP XX EQUIPMENT DAMAGE

RESP ENGR R.F.RAASCH

RELATED FMEAS

NONE

FMEA REQD YES NO

X

REFERENCES

NONE

HAZARD CAUSES

LACK OF ADEQUATE CONTRL/POWER REDUNDANCY OR OPERATIONAL BACK-UP

HAZARD EFFECTS

DAMAGE TO OR LOSS OF VEHICLE AND CREW

RELATED HAZARD ANALYSIS

1ZXX-0201-3B, 1ZXX-0506-18

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HAZARD NUMBER 1ZXX-0506-19

HAZARD IDENTIFICATION CONCURRENCEFUNCTIONAL LEAD JIM LIVINGSTONSAFETY LEAD W.E.PLAISTEDDISPOSITIONRESP GRP ACTION DOCUMENTATION

SINGLE POWER/CONTROL SYSTEM
BACKED UP BY DIFFERENTIAL BRAKING OF MAIN LANDING GEAR

392-610 VS70-510201

NLG STEERING SYSTEM INCORPORATES FAILURE DETECTION SYSTEM, FAILING INTO THE NLG "CASTER" MODE

388-301 MC621-0058

CLOSURE RATIONALE

HAZARD IS CLOSED BASED ON DESIGN REDUNDANCY/BACK-UP THAT ALLOWS CREW MEMBERS TO RETAIN DIRECTIONAL CONTROL OF VEHICLE AS INDICATED IN CORRECTIVE ACTION ABOVE PER SPEC MC621-0058 AND DRAWING VS70-510201

HAZARD DISPOSITION CONCURRENCE

FUNCTIONAL SUPERVISION	DEP-GRP	DATE	SAFETY SUPERVISION	DATE
L.A.UPDEGRAFF	392-610	062075	F.J.ATTAWAY	071075

HA-TRACK

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HAZARD ANALYSIS NUMBER	SUBSYSTEM/EQUIPMENT OR OPERATION	LEVEL	HZU	HAZARD STATUS	ENTRY DATE
INIT TRACK CAT					
1YXX-0506-20	ELECT.PWR.DIST.C CON	CR	CN/CN	123	CONTROLLED 102574

HAZARD DESCRIPTION

LOSS OF ELECTRICAL POWER/CONTROL TO PAYLOAD DEPLOY/RETRIEVAL SYS

FLIGHT TEST GROUND TEST FERRY FLIGHTS ORBITAL MISSION OTHER
PRELAUNCH LIFT OFF THRU ORBIT UN CRBIT X DE-CRBIT THRU LANDING

HAZARD GROUP XX EQUIPMENT DAMAGE

RESP ENGR K.F.RAASCH

RELATED FMEAS

FMEA REQD YES NC

NONE

X

REFERENCES

NONE

HAZARD CAUSES

LACK OF REDUNDANT POWER/CONTROL CAPABILITY

HAZARD EFFECTS

EQUIPMENT DAMAGE POSSIBLE RESULT IN INABILITY TO REENTER

RELATED HAZARD ANALYSIS

1YXX-0206-01,1YXX-0206-02

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HA-TRACK

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HAZARD ANALYSIS NUMBER	SUBSYSTEM/EQUIPMENT OR OPERATION	LEVEL	HZL INIT TRACK CAT	HAZARD STATUS	ENTRY DATE
1ZXX-0506-21	ELECT PWR DIST & CON	CA	CN/CN 123	CONTROLLED	073074

HAZARD DESCRIPTION

LOSS OF ELECTRICAL POWER/CONTROL TO RUDDER SUBSYSTEM

FLIGHT TEST	GROUND TEST	FERRY FLIGHTS	ORBITAL MISSION	OTHER X
ALL AERODYNAMIC FLIGHT MISSION PHASES				
PRELAUNCH	LIFT OFF THRU ORBIT X	UN LDET	DE-ORBIT THRU LANDING X	

HAZARD GROUP FF LOSS OF FLIGHT CONTROL RESP ENGR R.F.RAASCH

RELATED FMEAS

NONE

FMEA REQD YES NU

X

REFERENCES

MC621-0043B

HAZARD CAUSES

- 01-LOSS OF POWER (ELECTRICAL)
- 02-LOSS OF CONTROL

HAZARD EFFECTS

LOSS OF VEHICLE AND PERSONNEL

RELATED HAZARD ANALYSIS

1ZXX-0209-4A, 1ZXX-0209-4A-01,

HAZARD NUMBER 1ZXX-0506-21

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD R.E.ANTLETZ

SAFETY LEAD W.E.PLAISTED

DISPOSITION

RESP GRP ACTION DOCUMENTATION

01-POWER BY 3-28VDC BUS SEGMENTS
FOR EACH OF FOUR SERVO-LOOP &
VALVE DRIVERS PER PARAGRAPH
10.10.1.2 OF MC621-0043B

392-210 MC621-0043B

02-CONTROLLED BY FOUR MDM INPUTS
ONLY TWO OF WHICH ARE REQUIRED
TO FUNCTIONAL PER 10.10.1.2.
AS ABOVE

392-210 MC621-0043B

CLOSURE RATIONALE

HAZARD IS CLOSED BASED ON THE REDUNDANCY OF POWER, REDUNDANCY
OF FUNCTION, AND FUNCTION ASSESSMENT CAPABILITY OF THE SUBSYSTEM
PER SPECIFICATION MC621-0043B

HAZARD DISPOSITION CONCURRENCE

FUNCTIONAL SUPERVISION DEP-GRP	DATE	SAFETY SUPERVISION	DATE
R.E.ANTLETZ	392-210 062075	F.J.ATTAWAY	071075

HAZARD ANALYSIS NUMBER	SUBSYSTEM/EQUIPMENT OR OPERATION	LEVEL	H2D INIT TRACK CAT	HAZARD STATUS	ENTRY DATE
1ZXX-0506-22	ELECT PWR DIST & CON	CA	CN/CN 123	CONTROLLED	041674

HAZARD DESCRIPTION

LOSS OF ELECTRICAL POWER TO BODY FLAP

FLIGHT TEST	GROUND TEST	FERRY FLIGHTS	ORBITAL MISSION	OTHER
PRELAUNCH	LIFT OFF THRU ORBIT X	ON ORBIT	DE-ORBIT THRU LANDING	X

HAZARD GROUP FF LOSS OF FLIGHT CONTROL RESP ENGR R.F.RAASCH

RELATED FMEAS

FMEA REQD YES NO

NONE

X

REFERENCES

MC621-0043B

HAZARD CAUSES

- 01-LOSS OF POWER (ELECTRICAL)
- 02-LOSS OF CONTROL (ACTUATOR SIGNAL INPUT)
- 03-LOSS OF CONTROLLING SIGNAL (MDM PORT BLOCKAGE)

HAZARD EFFECTS

LOSS OF VEHICLE AND PERSONNEL

RELATED HAZARD ANALYSIS

01&02-1ZXX-0209-05 AND 1ZXX-0209-05-02; 03-1ZXX-0501-57

HAZARD NUMBER 1ZXX-0506-22

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD R.E.ANTLETZ

SAFETY LEAD W.E.PLAISTED

DISPOSITION

RESP GRP ACTION DOCUMENTATION

01-THREE 28VDC POWERED SECONDARY
ACTUATORS PROVIDED. ONE ACTUA-
TOR IS NECESSARY FOR CONTROL
PER PARA 10.10.1.3. OF MC621-
0043B

392-210 MC621-0043B

02-CONTROL TO ACTUATORS TRIPLY
REDUNDANT PER ABOVE

392-210 MC621-0043B

CLOSURE RATIONALE

HAZARD IS CLOSED BASED ON THE REDUNDANCY OF POWER, REDUNDANCY
OF FUNCTION, AND FUNCTION ASSESSMENT CAPABILITY OF THE SUBSYSTEM
PER MC621-0043B

HAZARD DISPOSITION CONCURRENCE

FUNCTIONAL SUPERVISION DEP-GRP DATE SAFETY SUPERVISION DATE

R.E.ANTLETZ 392-210 062075 F.J.ATTAWAY

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HAZARD ANALYSIS SUBSYSTEM/EQUIPMENT NUMBER	LEVEL OR OPERATION	H2D INIT TRACK CAT	HAZARD STATUS	ENTRY DATE
IYXX-0506-23	ELECT PWR DIST&CONTR	CA	CN/CN C12	CONTROLLED 072176

HAZARD DESCRIPTION

LOSS OF ELECTRICAL POWER/CONTROL TO PAYLOAD RETENTION SYSTEM

FLIGHT TEST GROUND TEST FERRY FLIGHTS ORBITAL MISSION X OTHER
PRELAUNCH X LIFT OFF THRU ORBIT X ON ORBIT X DE-ORBIT THRU LANDING X

HAZARD GROUP FF LOSS OF FLIGHT CONTROL

RESP.ENGR. R.F.RAASCH

RELATED FMEAS

NONE

FMEA REQD YES NO

X

REFERENCES

HAZARD CAUSES

- 01-LOSS OF POWER(ELECTRICAL)
- 02-LOSS OF CONTROL

HAZARD EFFECTS

RELEASE OF PAYLOAD IN LFF-DESIGN CONFIGURATION COULD CAUSE LOSS
OF ORBITER/CREW

171

90-1000-HS-272

HAZARD NUMBER 1YXX-0506-23

RELATED HAZARD ANALYSIS

1Z7X-0205-2A

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD JIM LIVINGSTONE SAFETY LEAD W.E.PLAISTED

DISPOSITION

01-PROVIDE REDUNDANT POWER

RESP GRP ACTION DOCUMENTATION

392-610 VS70-540202

02-PROVIDE REDUNDANT CONTROL
CAPABILITY

392-610 VS70-540202

CLOSURE RATIONALE

PAYOUT LATCH DRIVERS INCORPORATE TWO MOTORS, EACH POWERED FROM A DIFFERENT BUS. THREE STAGE TURN-ON(POWER-SELECT FUNCTION - AND ACTUATE)MINIMIZES INADVERTENT ACTUATION. POWER/CONTROL LOSS IN LATCHED STATE IS FAIL-SAFE. THIS HAZARD IS CLOSED, AS REPRESENTATIVE CIRCUITRY IS SHOWN SCHEMATICALLY IN VS70-540202 IMPLEMENTING THE CORRECTIVE ACTION ITEMS ABOVE

HAZARD ANALYSIS SUBSYSTEM/EQUIPMENT NUMBER	LEVEL OR OPERATION	INIT	HZD CAT	HAZARD STATUS	ENTRY DATE
1ZXX-0507-01 AVIONICS COMPUTER	CA	CN/CN	123	CONTROLLED	042274

HAZARD DESCRIPTION

A POWER INTERRUPTION OF GREATER THAN 400 MICROSECONDS CAUSES INITIATION OF COMPUTER SHUTDOWN. ONCE SHUTDOWN IS INITIATED, NO ATTEMPT AT RESTART WILL BE MADE

FLIGHT TEST X	GRUUND TEST	FERRY FLIGHTS	ORBITAL MISSION X	OTHER
PREL AUNCH	LIFT OFF THRU ORBIT X	ON ORBIT	DE-ORBIT THRU	LANDING X

HAZARD GROUP FF LOSS OF FLIGHT CONTROL	RESP. ENGR R.RAASCH
--	---------------------

RELATED FMEAS

FMEA REQD YES NO

05-6S

X

REFERENCES

MC615-0001 PARA. 3.2.1.5.3

HAZARD CAUSES

- 01-LIGHTNING STRIKE
- 02-SNEAK CIRCUIT PROBLEMS
- 03-SHOCK AND VIBRATION

HAZARD EFFECTS

LOSS OF ORBITER AND PERSONNEL

RELATED HAZARD ANALYSES

1ZXX-0401-04

HAZARD NUMBER 1ZXX-0507-01

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD R.P.O'EVELYN

SAFETY LEAD W.E.PLAISTED

DISPOSITION

RESP GRP ACTION DOCUMENTATION

01-03-MULTIPLE DC BUS SEGMENTS
TO PRECLUDE COMPLETE
POWER LOSS OR INTERRUPT AND
CONNECT POWER INTERRUPTION
SENSITIVE EQUIPMENT TO THESE
MULTIPLE BUS SEGMENTS AND EN-
SURE TWO OR MORE SOURCES OF
DC POWER TO COMPUTATIONAL
EQUIPMENT AT ALL TIMES PER
VS70-720211, VS70-720221,
VS70-720231

392-610 VS70-720211
VS70-720221
VS70-720231

CLOSURE RATIONALE

HAZARD IS CLOSED AS POWER INTERRUPTION IS NOT CREDIBLE BASED
ON APPROACH TAKEN IN CORRECTIVE ACTION NOTED ABOVE TO PREVENT
POWER INTERRUPT AS INDICATED IN THE FOLLOWING LISTED WIRING
DIAGRAMS:

VS70-720211 MASS MEMORY
VS70-720221 GPC POWER & CONTROL
VS70-720231 GPC SYNCHRONIZATION & FAILSAFE

HAZARD DISPOSITION CONCURRENCE

FUNCTIONAL SUPERVISION DEP-GRP DATE SAFETY SUPERVISION DATE

L.A.UPDEGRAFF 392-610 062075 F.J.ATTAWAY 071075

HA-TRACK

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HAZARD ANALYSIS SUBSYSTEM/EQUIPMENT NUMBER	LEVEL OR OPERATION	INIT	HZD TRACK CAT	HAZARD STATUS	ENTRY DATE
1ZXX 0507-02	AVIONICS COMPUTER	CA	CA/CN 123	DELETED	041574

HAZARD DESCRIPTION

DATA IN CORE BECOMES SCRAMBLED ALL COMPUTERS VOTE EACH OTHER OFF
THE LINE (REQUIRES FOUR SIMULTANEOUS FAILURES. BEYOND FO/FS
REQUIREMENTS

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HAZARD ANALYSIS NUMBER	SUBSYSTEM/EQUIPMENT OR OPERATION	LEVEL INIT	HZD TRACK	HAZARD CAT	HAZARD STATUS	ENTRY DATE
1YXX-0507-05	AVIONICS COMPUTER	CA	123	DELETED		110174

HAZARD DESCRIPTION

LOSS OF COMPUTER OUTPUT/ALL COMPUTERS (102 & SUBS)
(THIS HAZARD IS INCORPORATED IN 1YXX-0505-02)

HAZARD ANALYSIS NUMBER	SUBSYSTEM/EQUIPMENT OR OPERATION	LEVEL INIT TRACK	HZD CAT	HAZARD STATUS	ENTRY DATE
1ZXX-0507-03	AVIONICS COMPUTER	CA	CN/CN 123	CONTROLLED	041974

HAZARD DESCRIPTION

IF AN ERROR OCCURS IN THE FLIGHT CONTROL SOFTWARE AND MANUAL OVERRIDE IS ATTEMPTED, THE RESULT WILL BE A LOSS OF CONTROL

FLIGHT TEST X GROUND TEST FERRY FLIGHTS ORBITAL MISSION X OTHER
PRELAUNCH LIFT OFF THRU ORBIT X ON ORBIT DE-ORBIT THRU LANDING X

HAZARD GROUP FF LOSS OF FLIGHT CONTROL RESP. ENGR R.RAASCH

RELATED FMEAS

FMEA REQD YES NO

NONE

X

REFERENCES

MJ 070-0001-1 ORBITER CEI SPEC.PARA-3.3.5.5.1.1.1.

HAZARD CAUSES

A SOFTWARE BUG COULD THROW FLIGHT CONTROL SOFTWARE INTO UNEXPECTED BEHAVIOR. MANUAL OVERRIDE INPUTS TO THE SAME SOFTWARE

HAZARD EFFECTS

LOSS OF ORBITER AND PERSONNEL

RELATED HAZARD ANALYSES

1ZXX-0507-01; 1ZXX-0101-01,-02,-03; 1AXX-0503-05,-11,-12.

HAZARD NUMBER 1ZXX-0507-03

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD R.P.D'EVELYN

SAFETY LEAD W.E.PLAISTED

DISPOSITIONPROVIDE A BACKUP FLIGHT CONTROL
SYSTEM TO BYPASS REDUNDANT GPC
SOFTWARE GENERIC FAULT

RESP GRP ACTION DOCUMENTATION

393 MCR 901 REV A

RISK CAN BE REDUCED THROGH
EXTENSIVE TESTING OF SOFTWARE
DURING DEVELOPMENT (ADL/SAIL).

384-400

CLOSURE RATIONALEHAZARD CLOSED BASED ON AVAILABLILITY OF BFCS PER MCR 901 REV A
AND SUBSEQUENT DEVELOPMENT AND TESTING OF SOFTWAREHAZARD DISPOSITION CONCURRENCE

FUNCTIONAL SUPERVISION	DEP-GRP	DATE	SAFETY SUPERVISION	DATE
F.W.SPRINGE	383-400	062075	F.J.ATTAWAY	071075

HA-TRACK

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HAZARD ANALYSIS SUBSYSTEM/EQUIPMENT NUMBER	LEVEL OR OPERATION	INIT	HZD TRACK	CAT	HAZARD STATUS	ENTRY DATE
1YXX-0507-04	AVIONICS COMPUTER	CA	CN/CN	123	ELIMINATED	110174

HAZARD DESCRIPTION

ABERRATIVE COMPUTER OUTPUT-FIRING COMMANDS TO RCS WHEN STOWED

FLIGHT TEST GROUND TEST FERRY FLIGHTS CREITAL MISSION X OTHER
PRELAUNCH X LIFT OFF THRU ORBIT X ON ORBIT X DE-CREIT THRU LANDING X

HAZARD GROUP CC FIRE/EXPLOSION RESP. ENGR R.F.RAASCH

RELATED FMEAS FMEA REQD YES NO

02-4-041000 X

REFERENCES

MC467-0028, MC-87-CC29

HAZARD CAUSES

01-LOAD OF SOFTWARE (PROGRAM) WITH FAULT INTO MASS MEMORY
(SINGLE POINT SOFTWARE GENERIC ERROR)

HAZARD EFFECTS

LOSS OF VEHICLE AND/OR PERSONNEL THROUGH FIRE/EXPLOSION IN RCS
COMPARTMENT

RELATED HAZARD ANALYSES

1YXX-0302-03, 1YXX-0505-02

187

SD77-SH-0001-06

HAZARD NUMBER 1YXX-0507-04

HAZARD IDENTIFICATION CONCURRENCEFUNCTIONAL LEAD R.P.D'EVELYNDISPOSITION

01-RISK CAN BE REDUCED THROUGH
EXTENSIVE TESTING OF SOFTWARE
DURING DEVELOPMENT(ADL/SAIL)

CONSIDER OPERATIONAL PROCEDURES TO DISABLE RCS DURING CRITICAL MISSION PHASES

CLOSURE RATIONALE

RCS DOOR REMOVED PER MCR 1746. HAZARD NO LONGER EXISTS, HAS BEEN ELIMINATED

SAFETY LEAD W.E.PLAISTEDRESP GRP ACTION DOCUMENTATION

384-400

188

SD74-SII-0001-06

HA-TRACK

01/27/77 PAGE 1

HAZARD ANALYSIS NUMBER	SUBSYSTEM/EQUIPMENT OR OPERATION	LEVEL	H2D	HAZARD CAT	STATUS	ENTRY DATE
1ZXX-0507-06	COMPUTER SYSTEM	CR	CN/CN	023	CONTROLLED	012175

HAZARD DESCRIPTION

USE OF "LOC-TITE" IN APPLICATION WHERE IT CAN COME INTO CONTACT
WITH MAGNETIC TAPE

FLIGHT TEST	GROUND TEST	FERRY FLIGHTS	ORBITAL MISSION	OTHER	X
ALL MISSION PHASES					
PRELAUNCH	LIFT OFF THRU ORBIT	ON ORBIT	DE-ORBIT THRU	LANDING	

HAZARD GROUP FF LOSS OF FLIGHT CONTROL RESP ENGR R.F.RAASCH

RELATED FMEAS

NONE

FMEA REQD YES NO

X

REFERENCES

MSC 00134 REV A #220, IL NO.383-420-75-185 , MC615-0005

HAZARD CAUSES

01—"LOCTITE" CONTAINS CHEMICALS WHICH DAMAGE THE IRON OXIDE
COATING OF THE MAGNETIC TAPE

HAZARD EFFECTS

DAMAGE TO TAPE AND INFORMATION STORED THEREON

HAZARD NUMBER 12XX-0507-06

RELATED HAZARD ANALYSIS

NONE

HAZARD IDENTIFICATION CONCURRENCE

<u>FUNCTIONAL LEAD INTERFACE</u>	<u>SAFETY LEAD W.E.PLAISTED</u>
<u>DISPOSITION</u>	<u>RESP GRP ACTION DOCUMENTATION</u>
01-APPLICATIONS OF "LOCTITE" USAGE TO BE CONTROLLED BY NOTIFYING MASS MEMORY SUPPLIER	383-400 MC615-0005 SCDR RID NO.1-13-D2-01

CLOSURE RATIONALE

THIS HAZARD IS CLOSED BASED ON CLOSURE OF THE SUBJECT RID (GAMMA FERRIC OXIDE TAPE NOT AFFECTED - RE IBM IL HOLMES FROM KERINS DATED 12 JUNE 1975-002BC66) NOTE: GAMMA FERRIC OXIDE TAPE TO BE USED ON THIS PROGRAM IS DESIGNATED 3M 900

HAZARD DISPOSITION CONCURRENCE

<u>FUNCTIONAL SUPERVISION DEP-GRP</u>	<u>DATE</u>	<u>SAFETY SUPERVISION DATE</u>
F.W.SPRINGE	383-400 062675	F.J.ATTAWAY 070775